MAY 1, 1961

American Machinist / Metalworking Manufacturing

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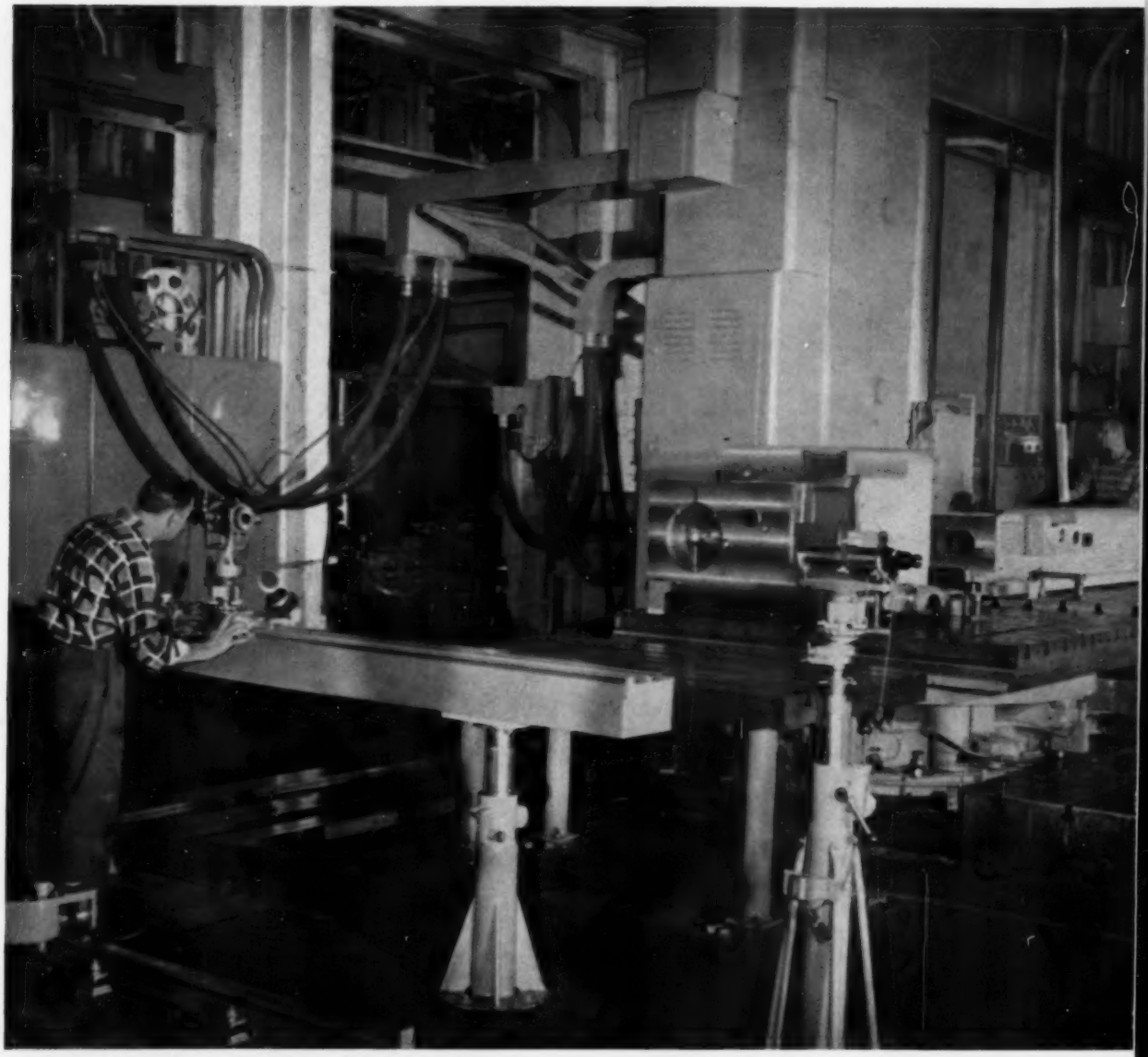

Optical setups for precision boring, see page 1

- **Elastic, incompressible plastic makes cheaper dies,** p74
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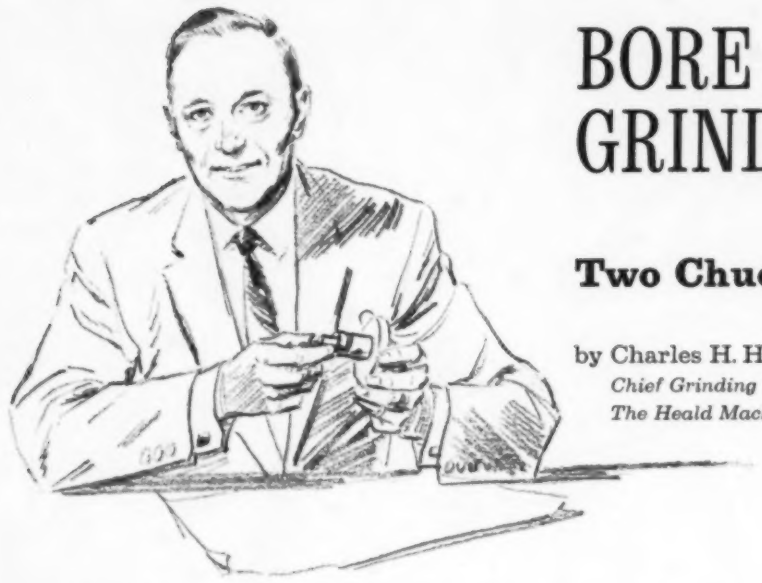


BORE AND FACE GRINDING...

Two Chuckings or One?

by Charles H. Hall
Chief Grinding Engineer
The Heald Machine Company

Many parts that call for an internal grinding operation also require precision finishing on an adjacent or associated face. This poses no particular problem, of course, and it usually presents an opportunity to make substantial savings by combining the two operations on a single machine.

The conventional method of grinding the bore on one machine and the face on another has some inherent disadvantages. It means two separate loading and grinding operations plus additional handling between machines. And since two chuckings are involved, the relationship between bore and face is subject to squareness variations which may or may not be serious.

If, on the other hand, the bore and face can be done at a single chucking, total floor-to-floor time can be greatly reduced. But even more important is the fact that squareness between bore and face can be positively assured.

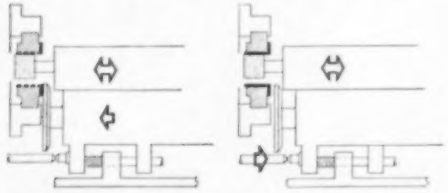
Combined bore and face grinding has been standard procedure with certain types of work on Heald two-spindle internals for many years. Several different methods can be employed, each of which has its own merits for a particular application.

Where cycle time must be kept to the minimum, slide-bar facing offers maximum efficiency and economy, for both surfaces are ground *simultaneously*. One wheelhead unit mounted on anti-friction slide bars holds the facing wheel in grinding position while a second wheelhead unit reciprocate grinds the bore.

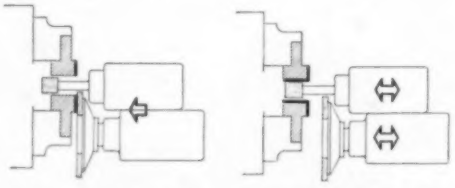
Where high production requirements are not a limiting factor, initial machine cost can be lowered by using a two-spindle machine arranged for sequential bore and face grinding, either with or without indexing of the wheelheads. Where bore tolerances are extremely close and indexing is not desired, fixed wheelheads can be arranged to permit manual plunge facing while the bore wheel enters the work without touching it. The table is then backed off to reciprocate-grind the bore.

Where indexing is permissible, a retractable facing head is often used. After the work is plunge faced, the facing head is retracted and table is indexed to align the bore wheelhead unit with the hole. This arrangement provides maximum versatility and permits the machine to be used as a bore grinder, a face grinder, or a combination of both.

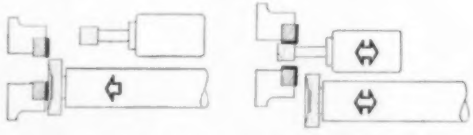
Whatever your requirements for bore and face grinding, it is probable that one of these two-spindle arrangements can be applied with a substantial reduction of initial investment, lower floor-to-floor cycle time and an improvement in quality as well.



Diagrams of slide-bar facing arrangement showing semi-finish bore grinding and face grinding at left and finish bore grinding at right.



Diagrams of sequential bore and face grinding with fixed wheelheads, showing face grinding at left and bore grinding at right.



Diagrams of sequential bore and face grinding with retractable facing head and cross slide indexing, showing face grinding at left and bore grinding at right.

Ask your Heald engineer for further details, or send for Bulletin 2-69-2. **It PAYS to come to Heald.**

THE HEALD MACHINE COMPANY

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COVER:

Optical gaging equipment built by Brunson locates within 0.0005 in. any point on a workpiece on this horizontal boring machine at Ingersoll Milling Machine Co. See page 71.

American Machinist / *Metalworking Manufacturing*

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TURN PAGE FOR METALWORKING REPORT——►

METALWORKING REPORT

. . . what's new and significant in manufacturing techniques and materials—direct from our own staff and round-the-world news bureaus

CUTTING . . . A graphite EDM electrode that lasts three times as long as brass has been developed by General Electric. Called Gentrode 10, it is claimed to **give the same finish as brass while cutting three times as fast.** The fine-grained carbon material comes in easy-to-machine slabs reported to be **free of the flaking and chipping problem** that has plagued graphite materials.

FINISHING . . . New electrochemical polishing of semiconductor wafers produces a surface so smooth that roughness cannot be detected even under an electron microscope at 53,000 power. At Bell Laboratories, slices of silicon and germanium are mounted on a nonconducting disk. After electrical contact is made to slices, they are placed on a polishing wheel flooded with electrolyte. As wheel rotates, a film of fluid separates work from wheel and maintains a fairly constant gap. **Anticipated savings are 50%, and the better finish gives a distinct improvement in electrical characteristics.**

MATERIALS . . . Mixed metal coatings in a matter of seconds are possible with a two-hole injection system that also **boosts plasma spray efficiency 20%.** With this system developed by Giannini Scientific Corp, Santa Ana, Calif, homogeneous coatings such as tungsten/alumina or nickel/alumina are introduced separately and **mixed in the plasma arc, producing coatings impossible with single spray coating.** Company also claims this will tailor coatings to suit coefficients of expansion of various substrates for different chemical or thermal requirements.

Zinc die casting competition

The 1961 "Zinc Die Casting of the Year" competition offers dual grand prizes this year—$500 to the winning die caster and $500 to his customer. The competition, sponsored by New Jersey Zinc Co, will be judged by W G Gude, editor of *Foundry*, George F Nordenholt, former chief editor of *Product Engineering*, and Burnham Finney, editor of *American Machinist/Metalworking Manufacturing*.

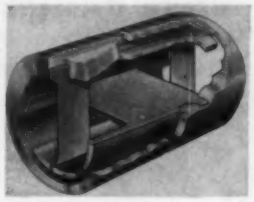
Awards will be made at the annual meeting of the American Die Casting Institute in Chicago, September 27. All producers of die castings, be they custom or captive, are eligible, and there is no limit to the number of entries from any one individual. Castings must be of zinc and must not have been produced prior to May 1, 1960.

All entries must be postmarked no later than July 31, 1961. For entry blanks and further information write to C R Maxon, New Jersey Zinc Co, 160 Front St, New York 38, NY.

LAYOUT . . . New machine makes printed circuit layout transparencies in 1/10 the time, at 1/10 the cost of conventional methods because it directly converts a freehand sketch into an accurate transparency. The Art-Mech, developed by the Special Products Div of Melpar, Inc **costs less than $3500 and eliminates the need for cameras and drafting.** An operator guides a stylus along sketch, and **machine transfers pattern to a thin plastic film.** This film can be used to prepare silk screen for quantity production runs, or to produce boards directly with the KPR process.

CLEANING . . . Pickling process directly applies a porcelain enamel cover coat on steel without usual ground coating and firing operation. In a process patented recently by Chas Pfizer & Co Inc, NYC, dry non-toxic **citric acid dissolved in water replaces sulfuric acid** and provides etching action necessary for direct-on enameling. Existing equipment can be used and, if necessary, the citric pickle can follow a sulfuric pickle.

COMPONENTS . . . Compact, non-friction device should take the place of ball-bearing assemblies in many pivot applications, according to Utica division of The Bendix Corp. Simple to install, it requires only simple machining of mating parts, and will operate without backlash and hysteresis. In addition, **no lubrication is required and dirt does not affect operation** of the pivot, which comes in cantilever and bridge-support types.



HEAT TREATING . . . Dry nitrogen atmosphere for hardening tool steels and special alloys at temperatures to 2400 F in open-chamber furnaces is being investigated by C I Hayes Co, Cranston, RI. This should aid diffusion of carbon in carburized work. Although nitrogen has a low carbon potential, indications are excellent that **carburized work or high-speed steel is not decarburized** in hardening or long annealing cycles.

MANUFACTURING CONTROL . . . Service areas don't interfere with manufacturing flow in a new bearing plant. At the Newington, Conn plant at Fafnir Bearing Co, two-story mezzanines on each side of the manufacturing area house auxiliary services. **The upper level, which serves plant personnel,** contains boilers, substations, lockers, first-aid rooms, and restrooms. **On the lower level, product needs are served** by tool cribs, inspection stations, and gage rooms. For more details, see p81.

INSPECTION . . . Gear checking system determines both true tooth-spacing error and eccentricity without analysis by a highly trained man. The new system from Michigan Tool includes a newly designed checker, translucent charts, and a light table. By plotting teeth on a circular graph, the pitch circle of gear or spline is located; super-imposing a blank chart on the tooth form circle locates shaft axis. Then, **difference of the two axes is a direct measure of eccentricity.** Chart also gives machine error check.

ASSEMBLY . . . A post-heating process improves electrical characteristics of assembled motor rotors, according to Selas Corp. In diecasting, stray filaments of aluminum are forced between the laminations. **By heating to just below the melting temperature, these tiny conductors are broken up.** In addition, the residual heat sometimes allows shrink fitting of the rotor to the shaft.

Continued on next page

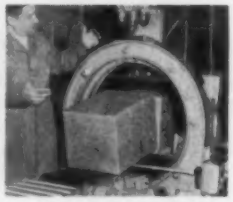
Coming in AM/MM

- *An inside look at Volkswagen*
- *The case for disposable insert tooling*
- *A preview of the Tool Show*

METALWORKING REPORT . . .

FINISHING . . . One setup gives 8630-steel spheres a heavier cadmium plate on inside than outside in a vacuum cadmium plating process developed by Anadite, Inc of South Gate, Calif, for air starter bottles for Lockheed's Navy P3V-1. In the process—which **guarantees 100% elimination of the potential for inducing hydrogen embrittlement**—Anadite simply puts more of the solid cadmium pellets inside the bottle than in the chamber for the outer surface. Processing time: 15 to 35 min for 0.0005 in. of cadmium.

MATERIALS HANDLING . . . Automatic bundling—in sequence—of different-size cartons is no problem with a steel-strapping machine that U S Steel has developed. **A "magic eye" on the machine scans each conveyor-borne carton** that passes under it, then adjusts itself to apply the right number of steel straps. Tensioning the straps, tying them, and cutting them off are all automatic functions of the new strapping machine.



FORMING . . . Elastic plastic can outwear rubber manyfold and may replace steel for forming dies. Very little machining of the polyurethane, known as ElastaCast, is required. **Production runs of 60,000 pc or more have been reported** by the distributor, Standard Die Set Co, Providence, RI. More deails on p74.

WELDING . . . Tomorrow's brazing furnace today is a cold-wall furnace capable of 4000 F with a controlled vacuum atmosphere. In it, and **with pure titanium as the brazing alloy,** The Martin Co has brazed columbium alloy (33% tantalum, 0.7% zirconium) and **produced joints with a shear strength at 3000 F comparable to the parent metal,** according to an AWS paper by M M Schwartz. Present cost is high, he admits, but ". . . the important thing is that a process has been developed."

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AMERICAN MACHINIST/METALWORKING MANUFACTURING, published bi-weekly by McGraw-Hill Publishing Company, Inc. James H. McGraw (1860-1948), Founder.

SUBSCRIPTION PRICE: Available only to paid subscription. Publisher reserves the right to refuse non-qualified subscriptions. Subscriptions are solicited only from manufacturing executives and engineers in the metalworking industries. Position and company connection must be indicated on subscription orders forwarded to address in box below. United States subscription rate for individuals in the field of the publication $3.00 per year, single copies 75 cents. Canada $4.00 per year, foreign $25.00 per year, payable in advance.

EXECUTIVE, EDITORIAL, CIRCULATION, ADVERTISING and PUBLICITY OFFICES: McGraw-Hill Building, 330 West 42nd St., New York 36, N. Y. Telephone: LOngacre 4-3000. Teletype: TWX N. Y. 1-1636. Cable Address: McGRAWHILL, New York.

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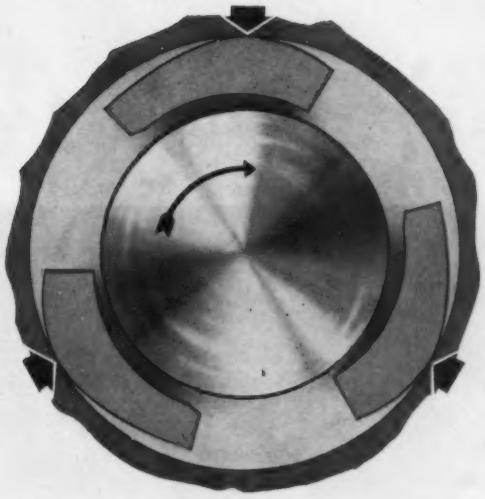

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Accuracy within millionths

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ACCURACIES WITHIN MILLIONTHS now are produced by the *grinding* process. No subsequent operations; accuracy and grinding cycles are gage controlled; work is ground to higher quality than ever before, assuring precise, predictable performance of the unit into which it is assembled. Cincinnati FILMATIC Super Precision Grinding brought about this miracle. "Results are fantastic," says one user, a missile subcontractor.

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The Grind-A-Mate gaging system completely controls the automatic grinding cycle. Parts may be matched ground to preset clearances throughout prolonged production runs, regardless of diameter variations. Our Grinding Specialists will be glad to provide further information regarding your particular application. Write or telephone today for Catalog G-730. **Grinding Machine Division, The Cincinnati Milling Machine Co.**

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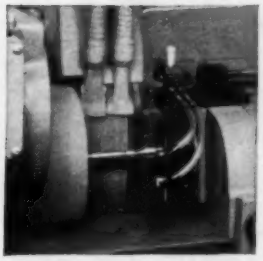

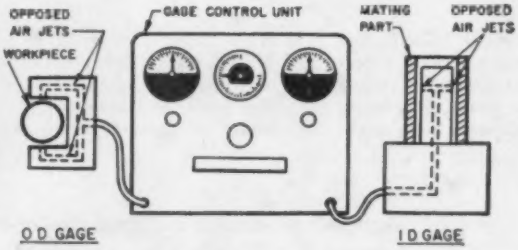

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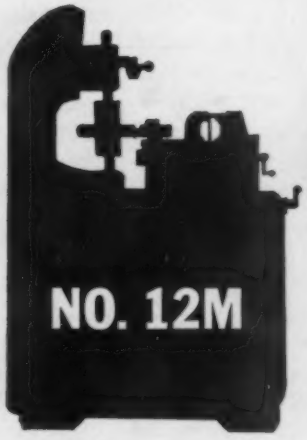

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NO. 20M RED LINER. For complete check of external and internal spur and helical gears. Maximum P.D. — 18″.

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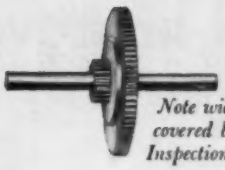

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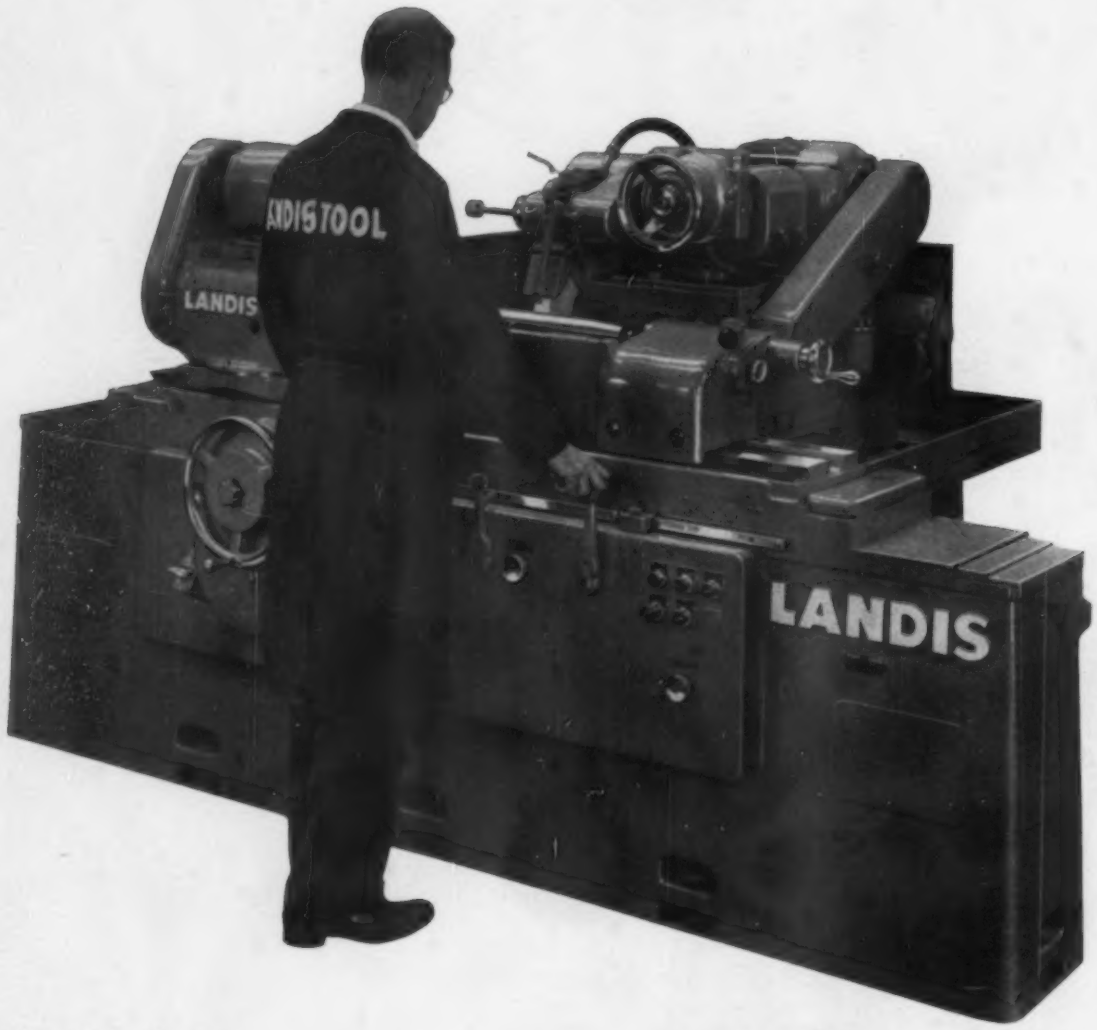


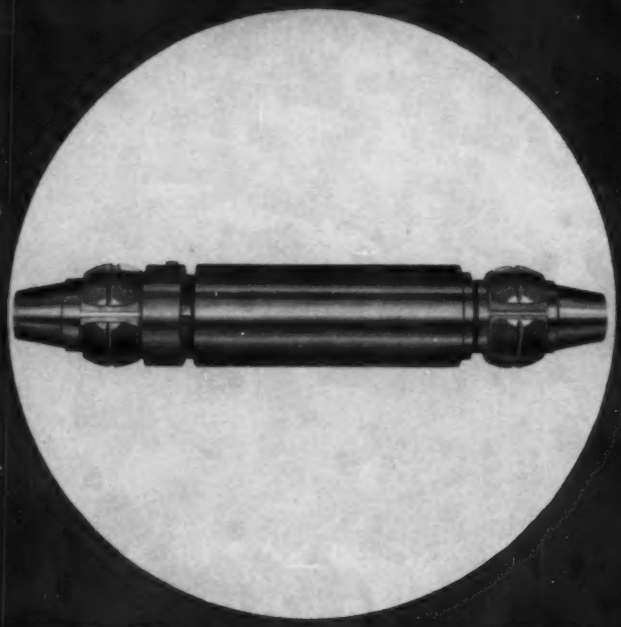
New Landis 14" x 36" R Universal Grinder

condensed specifications

	machine size	
	10" R	14" L R
Max. work swing	10 31/32"	14 3/4"
Lengths between centers	24"	36" - 48"
Standard grinding wheel	12" x 1" x 5"	14" x 1 1/2" x 5"
Work speeds—rpm (variable)	55 to 495	25 to 500
Traverse speeds—in. per min.	2 to 240	2 to 240
Wheel drive motor—hp.	2	3

Greater rigidity and balance of new swing type internal grinding fixture adds accuracy and convenience.

New hydraulic plunge feed available with turning handwheel to show rate and amount of feed.



Exclusive Landis Microsphere wheel spindle bearings submerged in circulating and filtered oil.

Improved machine alignment through better temperature control. Hydraulic reservoir isolated from bed.

LANDIS

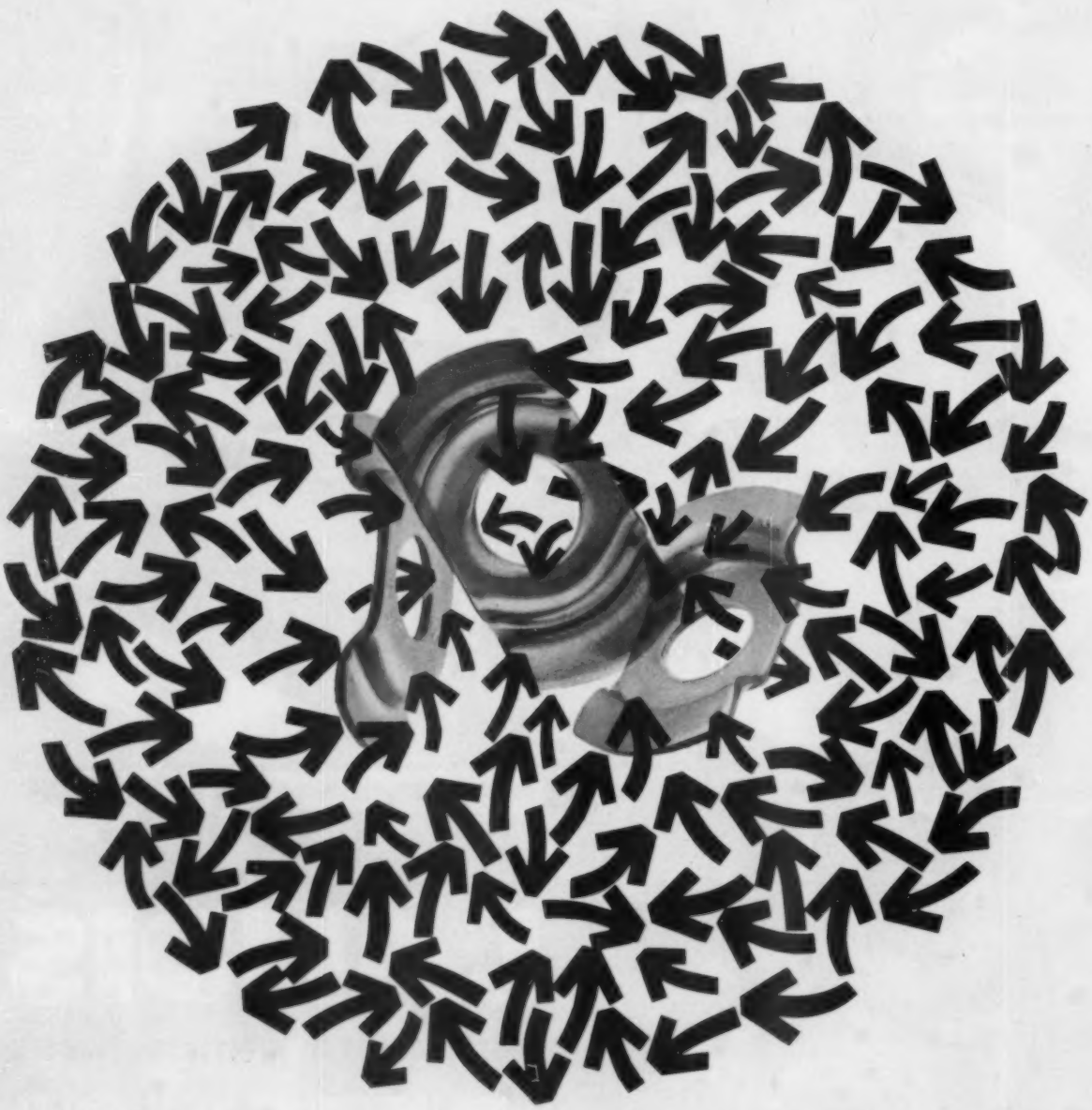
world leader in precision grinders

LANDIS TOOL COMPANY WAYNESBORO, PA.

now...
a finer, faster
finishing touch
created by three-dimensional vibration

The unique action of media in the New SWECO Vibro-Energy Finishing Mill literally "reaches around corners" to deburr and finish all surfaces better and quicker than ever before possible. The reason: highly efficient energy conversion to media and parts in work via high-frequency, yet gentle, three-dimensional vibration. The SWECO Vibro-Energy technique has been used for many years in the accurate separation of thousands of screenable materials. Also, Vibro-Energy has been successfully applied to ultra-fine (sub-micron) wet-grinding and dispersion. Following extensive development and field testing, SWECO Vibro-Energy now brings important economies and advantages to deburring, finishing, polishing, coloring and burnishing. An illustrated technical paper describes the principle and profit potential of this new SWECO application to metal, ceramic and plastic parts. A copy will be mailed promptly at your request. Write SOUTHWESTERN ENGINEERING COMPANY, 4800 Santa Fe, Dept. 70381 Los Angeles 58. *Vibro-Energy Separators, Grinding Mills, Finishing Mills*

SWECO



BK bond discs

ELIMINATE BURNING

Gardner cooler-cutting BK discs grind connecting rods without burning or work hardening—raise hourly output by 30%

production data

part . . . . . connecting rods
machine . . . Mattison vertical spindle grinder
rate . . . . . 455 parts per hr.
(former rate . . . . . 350 parts per hr.)
stock removal:
rough . . . . . .010"-.015"
finish . . . . . .005"-.010"

GARDNER

abrasive discs

GARDNER MACHINE COMPANY, BELOIT, WISCONSIN
a subsidiary of Landis Tool Company

This is AMERICAN OIL COMPANY

A sales organization especially trained to serve industrial and fleet customers . . . 74 District Offices and 13 Regional Offices . . . 4,100 warehouses and distribution points . . . 12 refineries . . . more than 2,000 products to serve you . . . this is American Oil Company.

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The American Oil Company representative who calls on you receives special training in servicing industrial and fleet customers at our Sales Engineering School. His training begins with a concentrated course in petroleum product quality and application. According to a planned schedule, he returns for an advanced course and then again for post-graduate work. From our Marketing Technical Service Department, your American Oil representative draws assistance, when needed, from specialists who are recognized authorities in their fields. These specialists may be called in at any time to work with you on your lubrication problems. More than a thousand research scientists and technicians at our research laboratory support the effort of our representative to serve you. Their mission: To help your American Oil representative help you lower your maintenance costs and stretch your maintenance dollars. Learn more about American Oil, its men, its service, its products.

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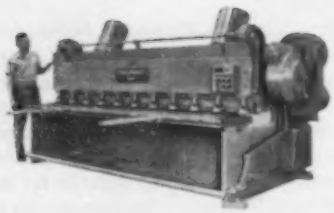
CINCINNATI®

MECHANICAL SHEARS

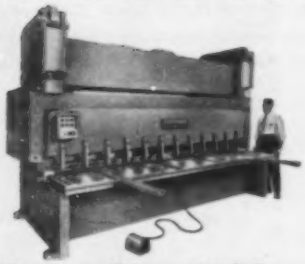


105 Standard Models

Capacities: 12 gauge to 1½″

Designed for high-speed operation, micrometer accuracy, low maintenance and minimum twist, bow, and camber.

HYDRAULIC SHEARS



34 Standard Models

Capacities: ¼″ to 1½″

The adjustable rake permits shearing a wide range of thicknesses on one machine for high return per dollar.

■ CINCINNATI Shears cut different thicknesses with one knife clearance; have powerful hydraulic holddowns; minimum deflection; and feature fast, accurate gage setting. Write or phone for new catalogs.

CINCINNATI

MECHANICAL PRESS BRAKES

82 Standard Models

Capacities: 50 to 2,000 tons

Your best choices for close-tolerance forming, high production, and maximum tonnage at bottom of the stroke.

HYDRAULIC PRESS BRAKES

59 Standard Models

Capacities: 300 to 2,000 tons

Check these machines if you produce a wide variety of shapes in relatively small lots, or require long stroke.

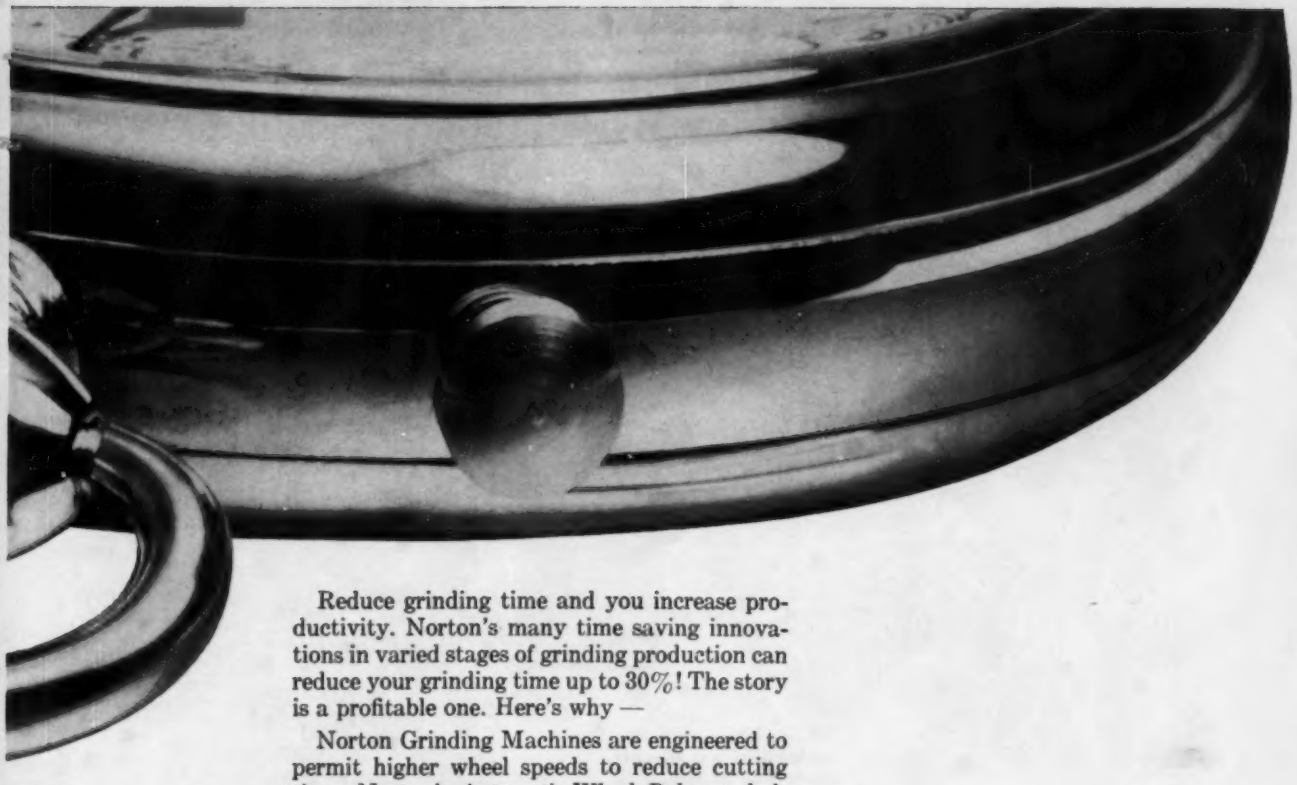
■ CINCINNATI Press Brakes have exclusive design advantages which reduce ram and bed deflection, cut maintenance, and minimize operator effort. Write or phone today for new catalogs.

THE **CINCINNATI SHAPER** CO.

Shapers / Shears / Press Brakes Cincinnati 11, Ohio, U. S. A.

In the United Kingdom: The Cincinnati Shaper Co., Ltd., Glasgow, Scotland

Time is the measure of productivity



Reduce grinding time and you increase productivity. Norton's many time saving innovations in varied stages of grinding production can reduce your grinding time up to 30%! The story is a profitable one. Here's why —

Norton Grinding Machines are engineered to permit higher wheel speeds to reduce cutting time. Norton's *Automatic Wheel Balancer* balances the wheel in *five seconds — on the machine.* You reduce time spent "grinding air" up to 85% because of Norton's *Automatic Wheel Contact Accelerator* which speeds the wheel to the work and compensates for work piece-diameter variation. Another advance is Norton's *Automatic Truing* which eliminates work interruptions and the *Automatic Wheel Wear Compensator* that stabilizes the grinding cycle.

Norton Grinders further add to your productivity by minimizing work spoilage with *Automatic In-Process Gaging.* In the case of surface grinders Norton *Higher Table Speed of 150 fpm* actually reduces grinding time up to 50%.

These are only some of the many reasons you can increase your productivity with Norton Grinders. They also offer accessories that literally transfer skills to machines — *ultra-fine feed,* and *automatic features* such as *steady resting, endwise locating, loading, constant peripheral wheel speed* and *hydraulically-operated feed screws* provide this competitive advantage.

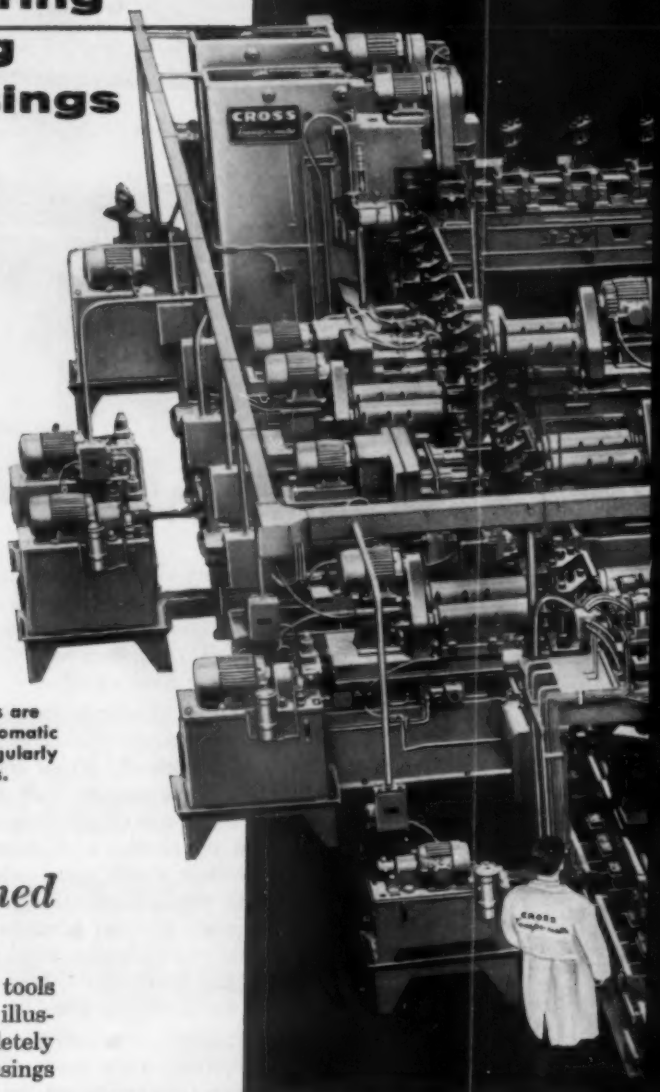
The decision is yours — can you afford not to reduce the time it takes to produce your product? Can you afford not to increase your productivity? Contact your Norton man, NORTON COMPANY, Machine Tool Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. In Canada: J. H. Ryder Machinery Co. Ltd., Toronto 5.

NORTON
MACHINE TOOLS
... Making better products to make your products better

MACHINE TOOL DIVISION: Grinding and Lapping Machines — G & E DIVISION: Shapers • Gear Cutting Machines

Milling, Drilling, Boring and Assembling Steering Gear Housings

Close tolerances are maintained in automatic processing of irregularly shaped parts.



New Transfer-matic Designed to Prevent Obsolescence

A typical example of how transfer type machine tools can be designed to guard against obsolescence is illustrated by this new Cross Transfer-matic. It completely machines and assembles power steering gear housings except for the mounting feet.

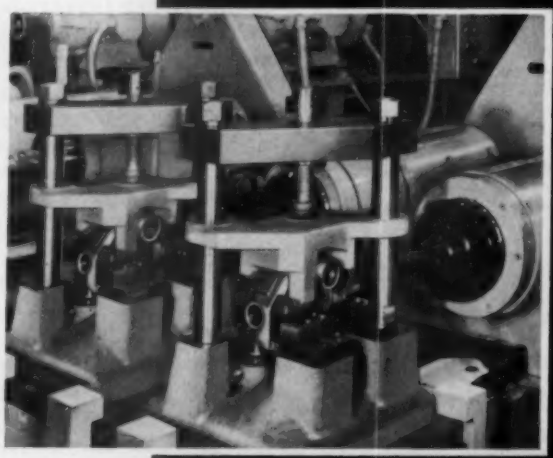
Useful life has been materially increased by building the Transfer-matic to process housings with longer pitman shaft extensions than those now being produced. Three idle stations permit other operations to be added and the use of standard Cross "building blocks" provides further flexibility for part design changes.

Present operations include milling, drilling, boring, counterboring, spot facing, chamfering, tapping, deburring, and assembling the worm thrust bearing cups and the pitman shaft bushings in the housings. Rated production is 300 pieces per hour.

A special feature is the provision for off-line inspection of the pallets and the parts without loss of production.

Another feature is the provision for in-line inspection at three different stations and final inspection just before the assembly operations.

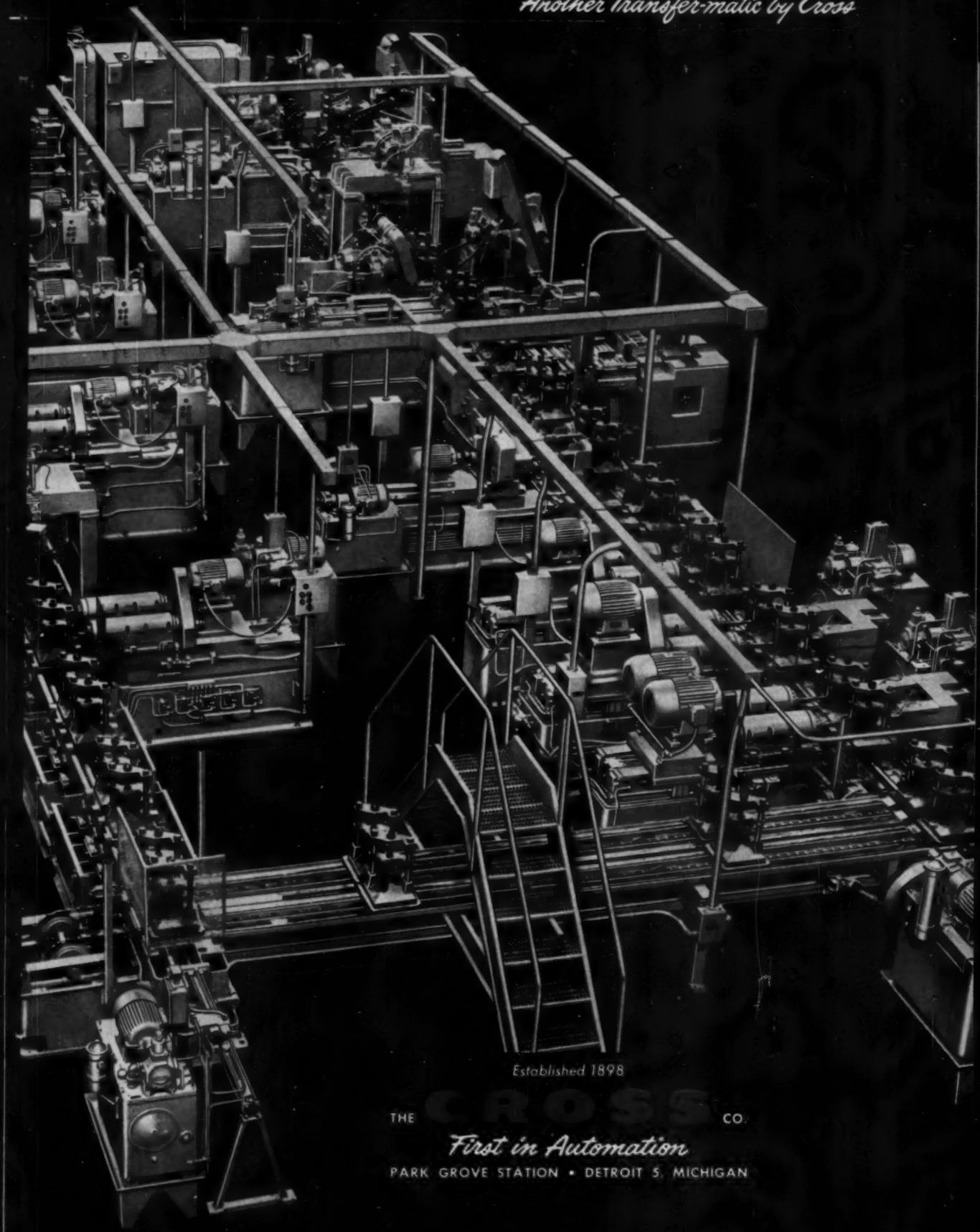
If you would like to know more about these and other Cross innovations, just drop us a line.



Precision boring of the worm shaft hole—two at a time.

CIRCLE 169 READER SERVICE CARD

Another Transfer-matic by Cross

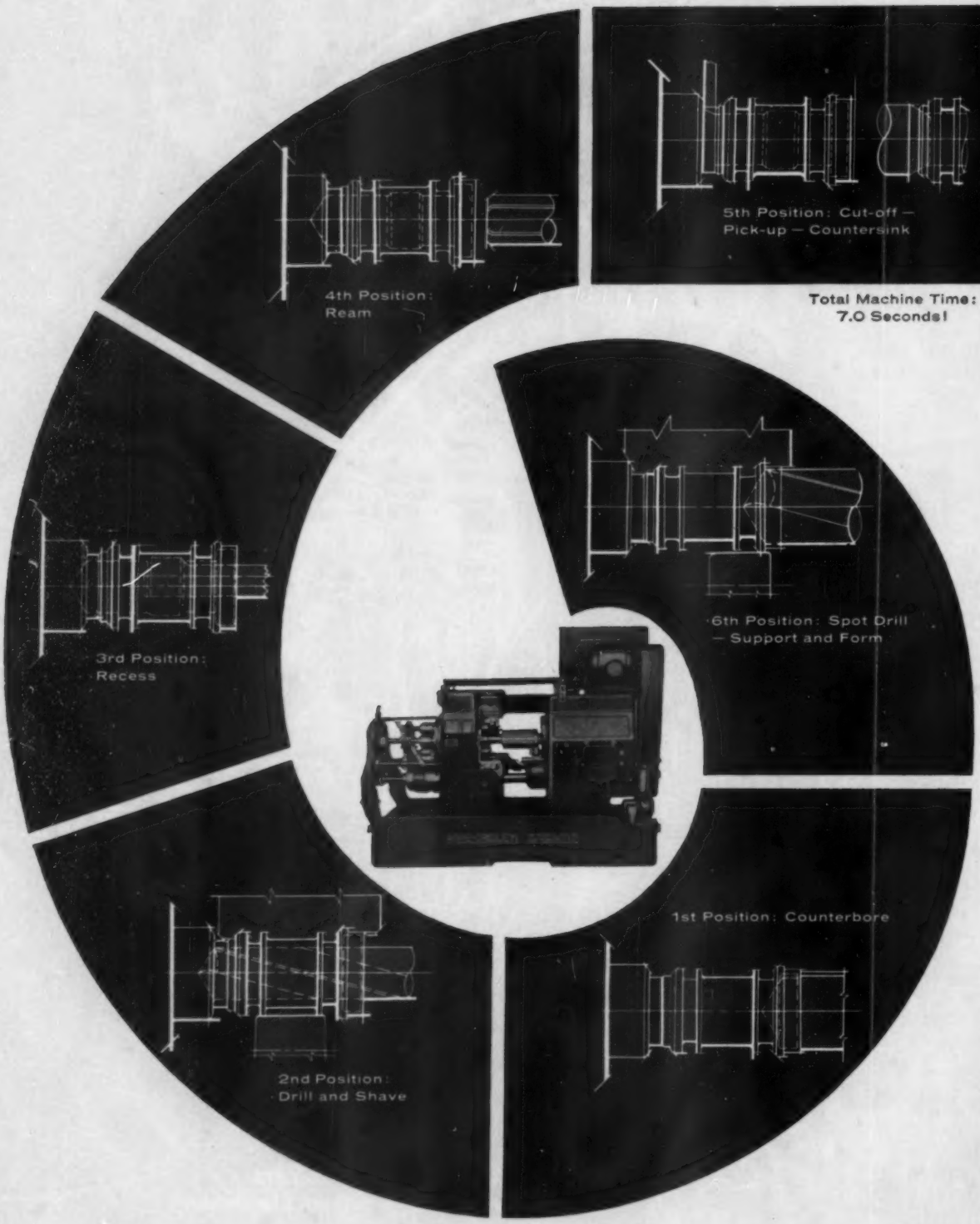


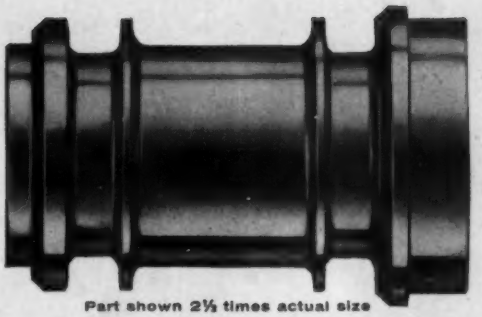
Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN


5th Position: Cut-off — Pick-up — Countersink
4th Position: Ream
Total Machine Time: 7.0 Seconds!
6th Position: Spot Drill — Support and Form
3rd Position: Recess
1st Position: Counterbore
2nd Position: Drill and Shave



Part shown 2½ times actual size

"EVEN WE WERE SURPRISED WHEN THE ACME-GRIDLEY DOUBLED OUR PRODUCTION

We'd refigured our set up for bushing blank production and were convinced that the Acme-Gridley would produce greater results than our current automatic machine set up. But, when we *doubled* production and wiped out a 7% reject rate to boot, we were amazed!"

Here at National Acme, we hear a lot of statements like this one made by Ness, Inc., up in Rochester, N. Y. They're one of the country's top product shops and tell us Acme-Gridleys have a lot to do with their success. Just about anybody who has to produce large amounts of an identical precision part will tell you the same thing.

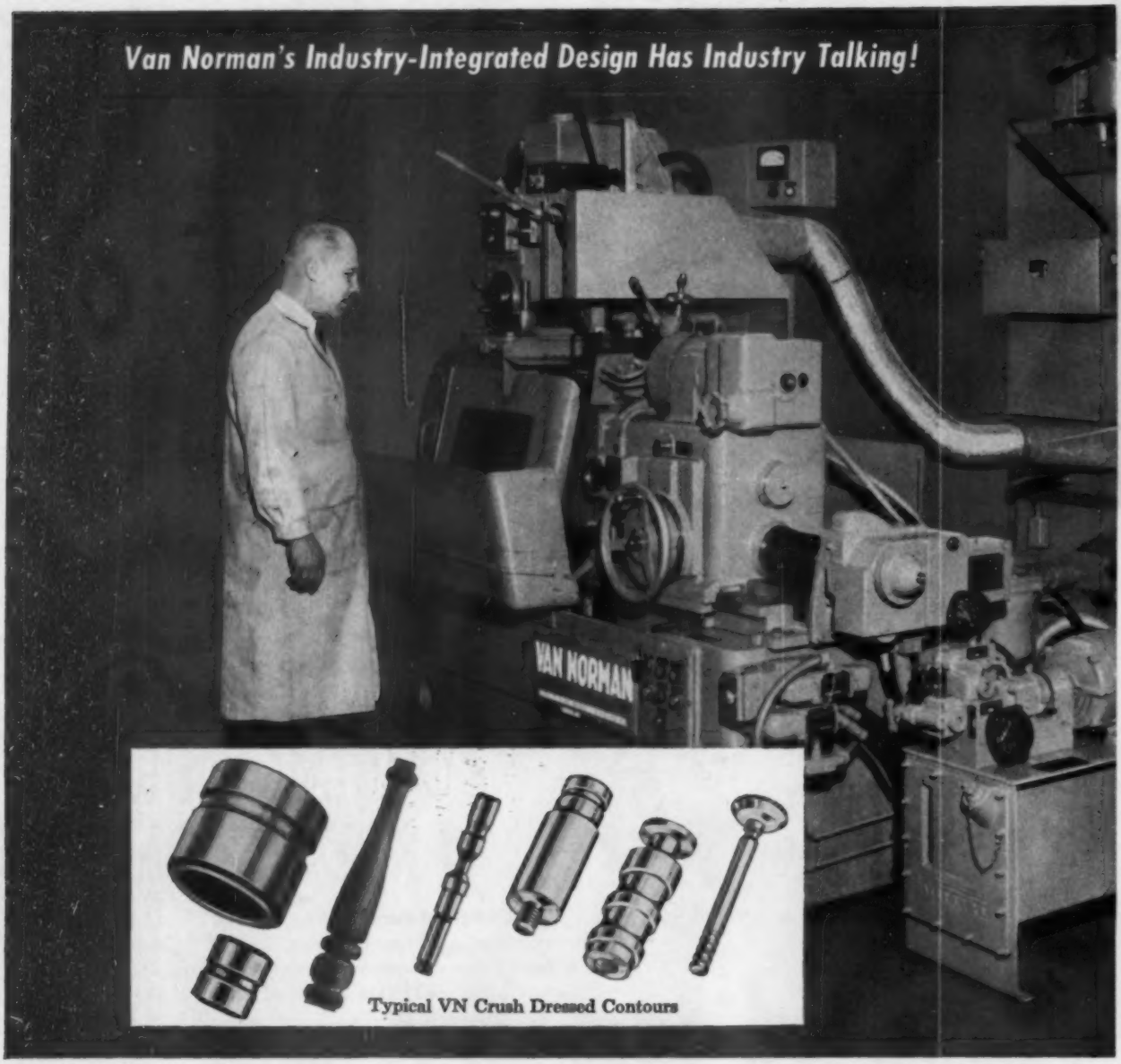
The number of *different* jobs that can be set up on an Acme-Gridley amazes everyone. To give you some idea, we've described some 57 actual jobs in a new 64 page bulletin called "Circumferential Automation at Work". For your free copy, call, write or wire.

National Acme

The National Acme Company
171 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

Van Norman's Industry-Integrated Design Has Industry Talking!



Typical VN Crush Dressed Contours

VAN NORMAN CRUSH FORM GRINDS AT HIGH SPEED . . . CLOSE

VN Centerless Grinders volume-produce or handle limited

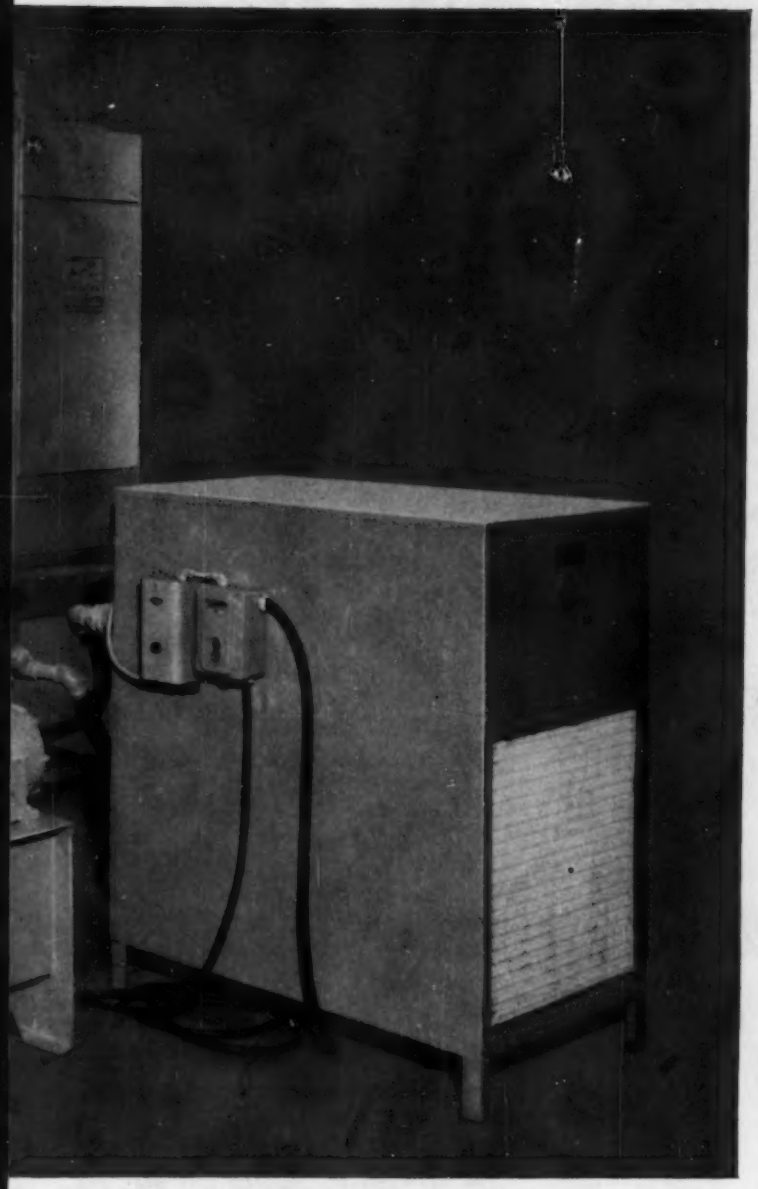
A Van Norman Centerless Grinder, with crush dress equipment, will grind intricate shapes and volume-produce many parts previously thought impossible.

Faster Output To Close Tolerances—typical of the high-speed, close-tolerance operations performed by Van Norman is the largest crush formed part shown above. A crush formed wheel grinds the O.D. and ball race simultaneously, holding .005 radius on the corner of the ball race, .001 tolerance on race curvature and .0005 tolerance on the O.D. and diameter of the ball race, with 10-12 RMS finish.

This part is ground in one operation, after a Thru-Feed grind on O.D. In the finish grind operation the O.D. and ball race are ground simultaneously to insure concen-

VAN NORMAN

SPRINGFIELD 7, MASSACHUSETTS



MANY PARTS TOLERANCES

runs with equal versatility . . . economy

tricity. Stock removal .004; Infeed cycle 12 seconds. Result: five parts are finished per minute, 300 per hour.

Free Booklet—"Centerless Grinding"—valuable guide to high production, lower costs. For your copy, contact factory or your local distributor.

4134

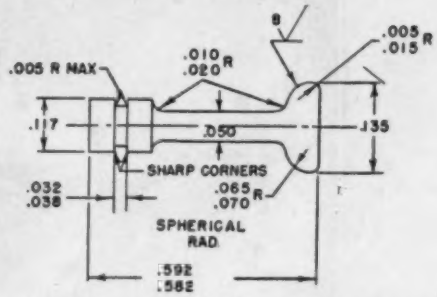
MACHINE COMPANY

A DIVISION OF VAN NORMAN INDUSTRIES, INCORPORATED

VN

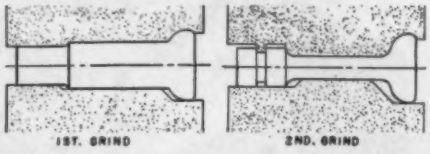
Another typical Van Norman centerless grinder cost-saving application

CUSTOMER'S PROBLEM:



To produce at the lowest possible cost this small nozzle valve used in the manufacture of fuel injectors. Present method used was to rough turn part on screw machine, harden, then finish grind in 5 different operations at very high cost. The material is high speed steel hardened to Rockwell 58-62 "C" scale. An R.M.S. finish of better than 10 required.

VAN NORMAN SOLUTION:



By using the Van Norman crush forming method the part is ground from a hardened blank in three operations and all tolerances held as specified. (1) In the first operation the part was roughed as shown in sketch, forming both the regulating and grinding wheel to shape shown to give the part full support during grinding operation. (2) In the 2nd operation the narrow groove as well as the long diameter in the center and the .010/.020 radii was finish ground. (3) In the last operation the diameter was finish ground to assure sharp corners called for and also finish valve radius .065/.070 to finish size and finish of 8 R.M.S.

THE RESULT:

The three operations were accomplished in record time. 1st operation—180 pieces per hour at 100%. 2nd operation—150 pieces per hour at 100%. 3rd operation—180 pieces per hour. Cost savings over old method were tremendous. Actual figures on old method are not accurate but savings amounted to over 400%.

How Bob Clark increased

After getting his B.A. at Illinois College, Bay State Abrasive Specialist Robert M. Clark joined U.S. Steel where his work gave him a great deal of highly practical experience in metal-working problems. Since coming to Bay State in 1956, he has been in contact with just about every type of metal-working operation in the Chicago area and he's proven his skill by diagnosing and curing some unusual grinding shop ailments.

Getting a 20% increase in wheel life is a solid bonanza in any grinding operation, but there's more to this Bay State case history than that. It's an excellent example of the way careful analysis of the *whole* abrasive problem can pay *multiple* dividends.

It started with a simple test. Two unmarked Bay State diamond wheels were delivered to Cummins Engine Company, Inc., Columbus, Indiana, for a performance check against two competitors' wheels under standard shop conditions. Fifty-five days later the competition's wheels were completely used up. The Bay State wheels lasted 66 days.

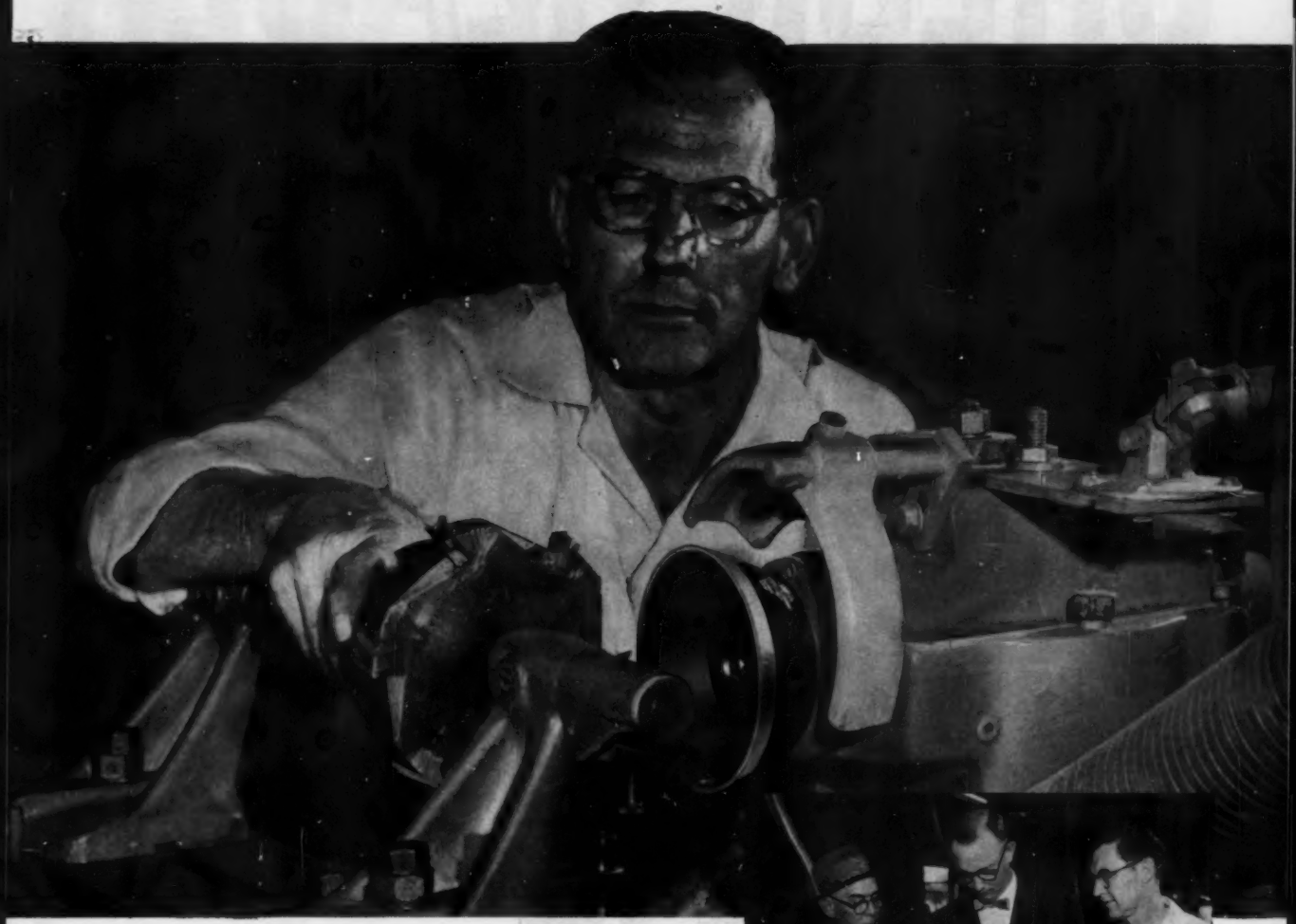
Since both types of wheels had been doing identically the same kind of work . . . and both carried exactly the same price tag . . . the 20% longer life of the Bay State wheels represented a solid cash saving.

On top of this, however, Bay State Abrasive Specialist Bob Clark found that wheels of ⅛" diamond depth could be used on certain jobs instead of the ¼" depth wheels used in the test with an additional saving of $13,000 a year. And, finally, he worked out a new quantity-ordering system for Cummins that saved a further $1,824.00 annually and also insured against emergency shortages of wheels.

Bob Clark's outstanding thoroughness and demonstrated ability in this case have led to his being asked to survey all of Cummins diamond wheel applications and work out optimum wheel specifications for each job.

Diamond grinding is a highly specialized technique, of course, but even if your grinding operations call only for well-known standard specifications, there's an excellent chance that Bay State can give you improved performance. Why not call in your Bay State distributor or direct factory representative and put him to work? *Better grinding at lower cost . . . that is his business.*

diamond wheel life from 55 to 66 days at Cummins Engine Company, Inc.



Operator Charles Adams prepares to make the first pass on a milling cutter with Bay State diamond cup wheel of ⅛" diamond depth. This is the actual specification that out-performed competing wheels by 20%.

Discussing the advantages of 1/16" diamond thickness wheel for specialized operations are (left to right): John Hedges, Supervisor of Tool Control at Cummins, Bay State Abrasive Specialist Bob Clark and Cummins Abrasive Investigator Robert Elliot.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

CHECK READER BY MANUFACTURI MEN AND YOU'LL FIND THIS IS METALWORKIN MOST POWERF SELLING TOOL

SHIP

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If you sell to metalworking, ask your customers to tell you which business publications they find most useful in their work—then advertise there. Twenty-five companies conducted such surveys on their own during the last 10 years—and American Machinist/Metalworking Manufacturing was consistently the winner . . . hands down!

Reason? AM/MM is the technical publication of metalworking—and metalworking is a highly technical industry.

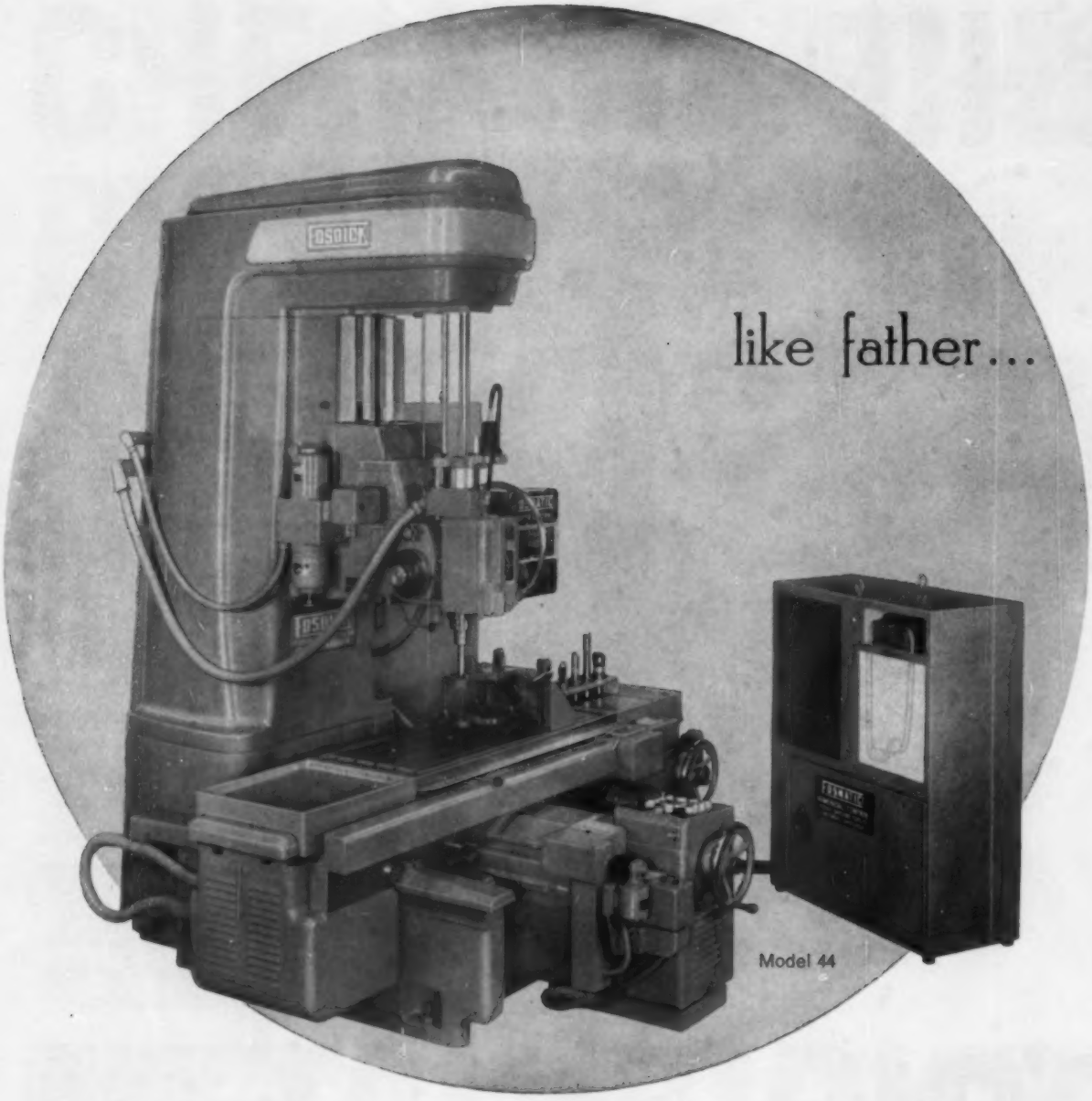
AM/MM concentrates on how-to articles, case histories and *working* information on the often highly complex methods and procedures involved in manufacturing things from metal more efficiently, more profitably. In short, it's a 26-times-a-year work book. If metalworking is your market, it will work for you.

For up-to-date facts and figures on metalworking, ask your AM/MM *district manager for a copy of the 1960 Market Guide for Sales Executives.*

In metalworking—men who matter read...

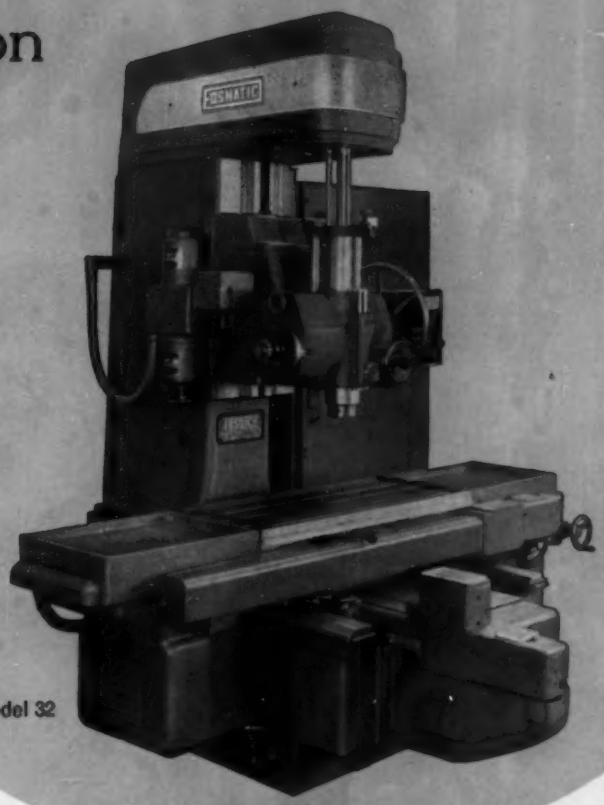
American Machinist / ***Metalworking Manufacturing***

A McGraw-Hill Publication, 330 West 42nd Street, New York 36, N. Y.



Specifications	32	42	44	54
Table working surfaces	18" x 32"	18" x 42"	44" x 22"	54" x 22"
Table travel	18" x 30"	20" x 36"	22" x 42"	28" x 48"
Spindle nose to table top	4" to 22½"	4" to 28½"	6" to 30"	6" to 30"
Spindle center to column face	16½"	16½"	18½"	18½"
Spindle center to column throat	21"	21"	25¼"	30½"
Column throat to table top	16"	16"	22"	22"
Head travel on column	9½"	15½"	15"	15"
Spindle travel in head	9"	9"	9"	9"
Speeds	62-3000 rpm	62-3000 rpm	30-1800 rpm	30-1800 rpm
Feeds—inches per revolution	.0005 to .015	.0005 to .015	.0005 to .015	.0005 to .015
Motor	3 hp 1800 rpm	3 hp 1800 rpm	3 hp 900/1800rpm	3 hp 900/1800rpm
Floor space (without numerical control)	98" x 120"	98" x 134"	123" x 140"	134" x 156"
(numerical control console)	25" x 48"	25" x 48"	25" x 48"	25" x 48"
Net weight	10,000 lb.	11,000 lb.	21,500 lb.	23,500 lb.

...like son



Model 32

New Compact Jig Borers

Like father like son, the same features that made the reputation of the big Fosmatic 44 and 54 Precision Boring Machines are now available in two smaller size machines, the Model 32 with 18″ x 30″ table travel, and the Model 42 with 20″ x 36″ table travel.

These completely new machines are ideal for boring jobs on missile parts and similar delicate jobs that require extreme accuracies. The 32 and 42 are equally at home on jig-boring jobs in the toolroom, or on extended production runs.

Like the big Fosmatics, they offer direct dimension measuring for establishing locations quickly by direct-reading dials. They also give you automatic positioning that brings table and saddle into location at the touch of a button to accuracies of ±.0001″. Push-button control of speeds and feeds is standard on both jig borers.

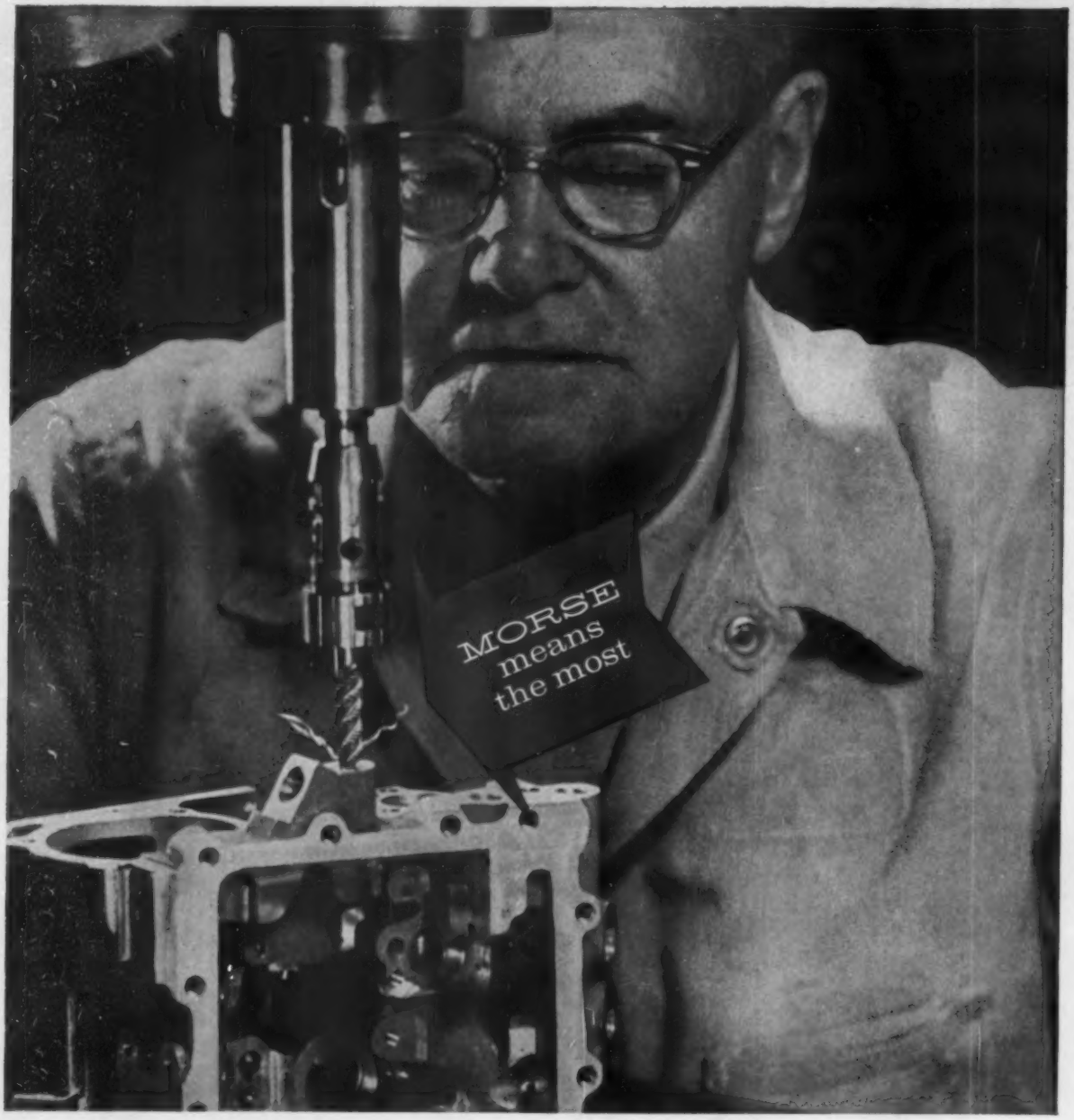
Numerical control? Absolutely! The same full Fosmatic numerical control in three dimensions, outstandingly successful on big 44 and 54, is also available on the 32 and 42.

If you have been wishing for a smaller machine with the big Fosmatic features, then the 32 and 42 are just what you asked for. Call your Fosdick distributor to learn more about these two new members of our family. And get a proposal from Fosdick!

FOSDICK

THE FOSDICK MACHINE TOOL CO.
CINCINNATI 23, OHIO

with men who know cutting tools... it's MORSE everytime



TRY MORSE... BUY MORSE
SEE YOUR NEARBY MORSE DISTRIBUTOR

MORSE

MORSE TWIST DRILL & MACHINE CO.
NEW BEDFORD, MASSACHUSETTS

A Division of VAN NORMAN INDUSTRIES, INC.

WAREHOUSES IN: NEW YORK • CHICAGO • DETROIT • DALLAS • SAN FRANCISCO

CIRCLE 181 READER SERVICE CARD

CIRCLE 182 READER SERVICE CARD ►

Exclusive New Britain design *for greater boring accuracy*

This is the vertical slide of one of the new series New Britain Vertical Contour Turning and Boring Machines with the front plate removed exposing the cams. These cams are mounted on a common shaft which rides with the vertical slide controlling its motion as well as the motion of the cross slide. Containing all slide actuating forces in the vertical slide is an exclusive New Britain feature which represents a major development in boring machine design.

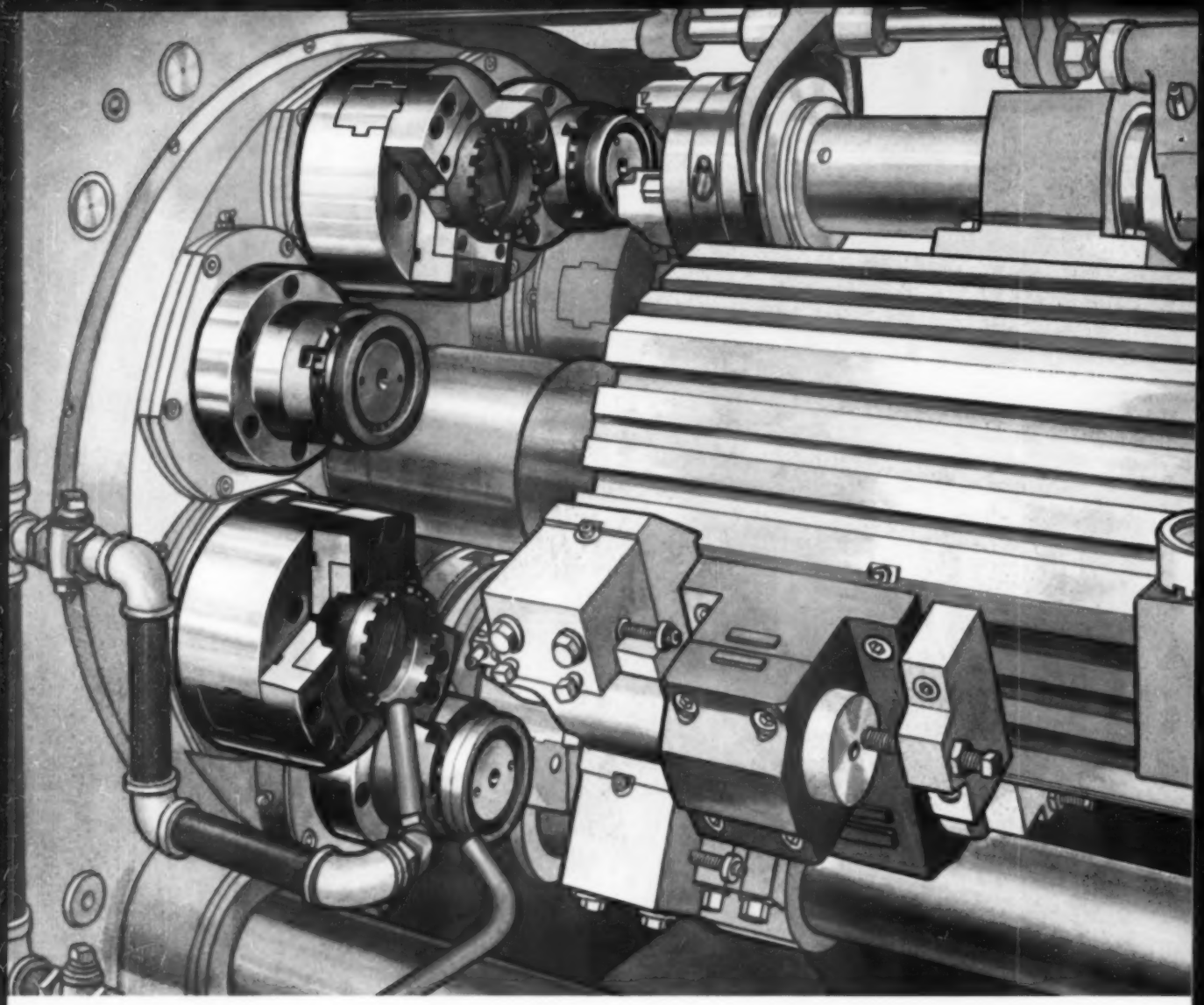
No outside forces are imposed on the slide ways. Extreme accuracy and rigidity are achieved permitting heavy cuts. Finish cuts of less than .0003 tolerance can be made on the same set-up.

The elimination of long actuating linkages has allowed for the design of a compact, clean sided, simplified machine. Cams are quickly accessible and easy to change.

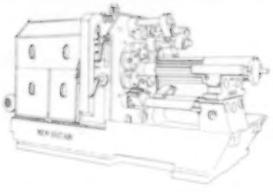
The major improvement which the cam-in-head principle makes on the already widely accepted superiority of cam control results in high repetitive accuracy regardless of the complexity of the piece. Building-block applications, using more than one machine side by side, allow all kinds of possibilities for increased production efficiency.

THE NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division ◆ New Britain, Connecticut



Double indexing . . . differential chucking pressures *with New Britains*



Here are two features that go a long way toward indicating how much and what kind of work you can do on New Britain's Chuckers. The double indexing feature is a really workable approach to the production of two identical pieces per cycle or both sides of a piece. This application can frequently eliminate the need for second-operation machines. Chucking pressures can be adjusted so that as the machine progresses through the cycle, and more and more metal is removed, the piece will not be distorted.

These are only two of a dozen different New Britain Chucking Machine features. These rugged, powerful machines are your best bet for high production turning, forming, facing, threading, tapping and related operations. New Britain's complete line of chuckers includes four-, six- and eight-spindle models, with work swing up to 17 inches. Wide open design in all models allows for the quickest possible disposition of chips.

Make a point of calling in your New Britain representative soon. Let him show you the dollars and cents reasons for including New Britains in your replacement or expansion plans.

THE NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division • New Britain, Connecticut

ONLY SQUARE D STARTERS WITH ONE-PIECE OVERLOAD RELAYS GIVE ABSOLUTE PROTECTION!

• Only Square D makes thermal overload relays with 1-piece construction—and only with 1-piece construction can you *know* you've installed the heater correctly. Square D 1-piece overload relays can be installed only one way. They are factory-assembled, individually tested and calibrated, completely tamper-proof. Repeated tripping will not affect accuracy.

You *pay* for overload protection—be sure you *get* it. Insist on Square D 1-piece overload relays for *absolute* protection.

Heat-responsive element (solder pot) provides accurate response to overload, yet prevents nuisance tripping.
Heat-producing element is an integral part of overload unit. It's permanently joined to solder pot, can't become misaligned.

D EXCLUSIVE— 1-piece Overload Relay for *ABSOLUTE* Protection!

Mail coupon today for simple "jig-saw" demonstrator —see why only Square D gives absolute protection

Square D Company
Department SA-236
4041 North Richards Street
Milwaukee 12, Wisconsin

Please send me information on Square D magnetic starters, along with your simple 3-minute "jig-saw" demonstrator

NAME_____

COMPANY_____

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CITY_____ ZONE____ STATE_____

SQUARE D COMPANY

wherever electricity is distributed and controlled

◄ CIRCLE 183 READER SERVICE CARD

CIRCLE 184 READER SERVICE CARD

Ready-Power switches to **Columbia-Southern Trichlor** to solve corrosion problem and save equipment in used motor degreasing

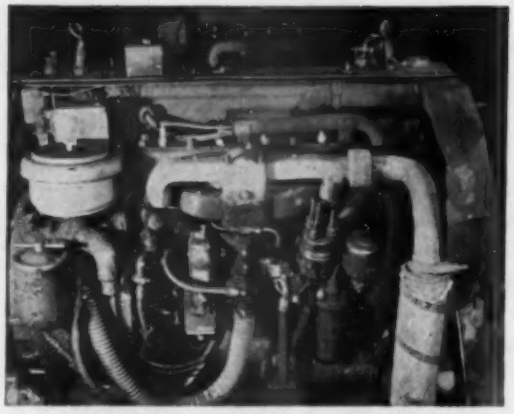
The Ready-Power Company of Detroit manufactures gasoline and diesel electric power units for fork-lift trucks, crane trucks, platform trucks and other materials-handling equipment. They also repair and rebuild used power units which have spent years in the most rugged kind of service. And this is where Columbia-Southern TRICHLOR comes into play.

The used power units, as received by Ready-Power, have been exposed to corrosive residues from fuel and lubricating oils, carbon black, salt, foundry dust, acid pickling materials and similar soils from virtually every type of industry. In service these contaminants build up a thick layer of grease and "gunk." Before Ready-Power's maintenance experts can diagnose and repair the units, the heavy coating of contaminants must go. A vapor degreasing operation proved to be the most efficient method of removing all soils down to the metal, without harm to any of the parts or surfaces.

Soon after installing the vapor degreasing system, though, Ready-Power ran into a problem. The solvent they were using soured rapidly, due to the combination of materials the used power units had picked up in their years of heavy service. In fact, the active acid content of the solvent built up so quickly that it was corroding the tank. In a short time, replacement of the new equipment might be required.

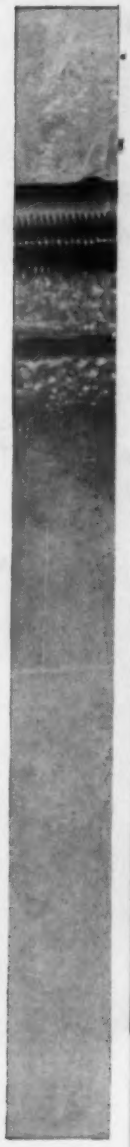
At this point, the Trichlor distributor in Ready-Power's area—Progressive Chemical Company of Detroit—teamed up with the maintenance and production people at Ready-Power to eliminate the source of equipment corrosion. Because Columbia-Southern Trichlor has a heavy-duty stabilizer system built into it for just such operating conditions, the degreasing system was charged with Trichlor and put into operation.

Result: The corrosion which threatened to cause equipment replacement stopped immediately and had never resumed since *neutral* Columbia-Southern Trichlor has been on the job. Units come clean—fast and economically—thanks to Trichlor and helpful service from Progressive Chemical, the distributor.



Ready-Power must remove this heavy accumulation of grease, dirt and acidic soil before diagnosing and repairing used unit. Degreasing is the answer to low-cost, safe cleaning of units returned for service.

It's help like this, plus the consistently high quality of the product, that makes Ready-Power a steady user of Columbia-Southern Trichlor. Perhaps *your* operation could benefit, too. Why not call on your Trichlor distributor or the PPG Chemical Division office nearest you?

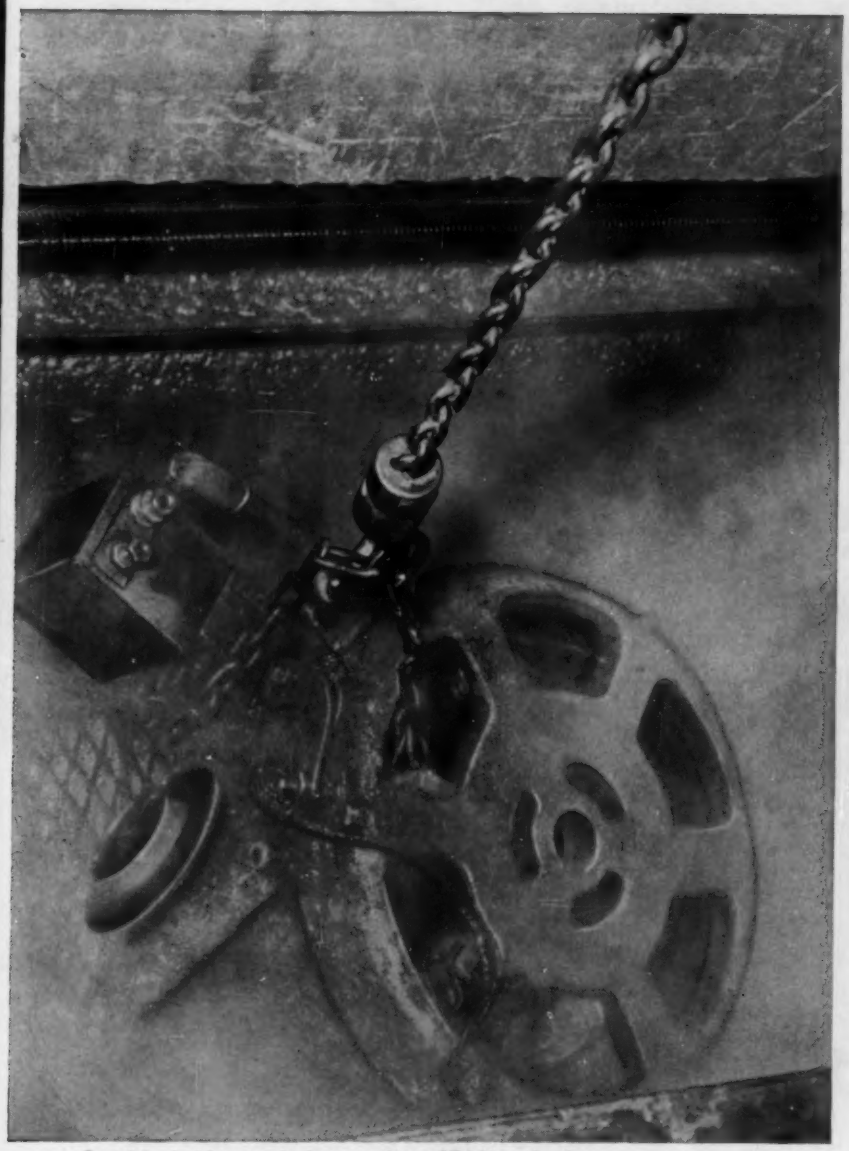


columbia | southern chemicals

CHEMICAL DIVISION

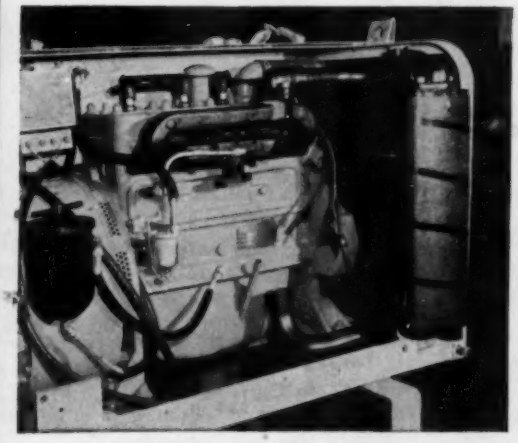
PITTSBURGH PLATE GLASS COMPANY

ONE GATEWAY CENTER PITTSBURGH 22, PENNSYLVANIA



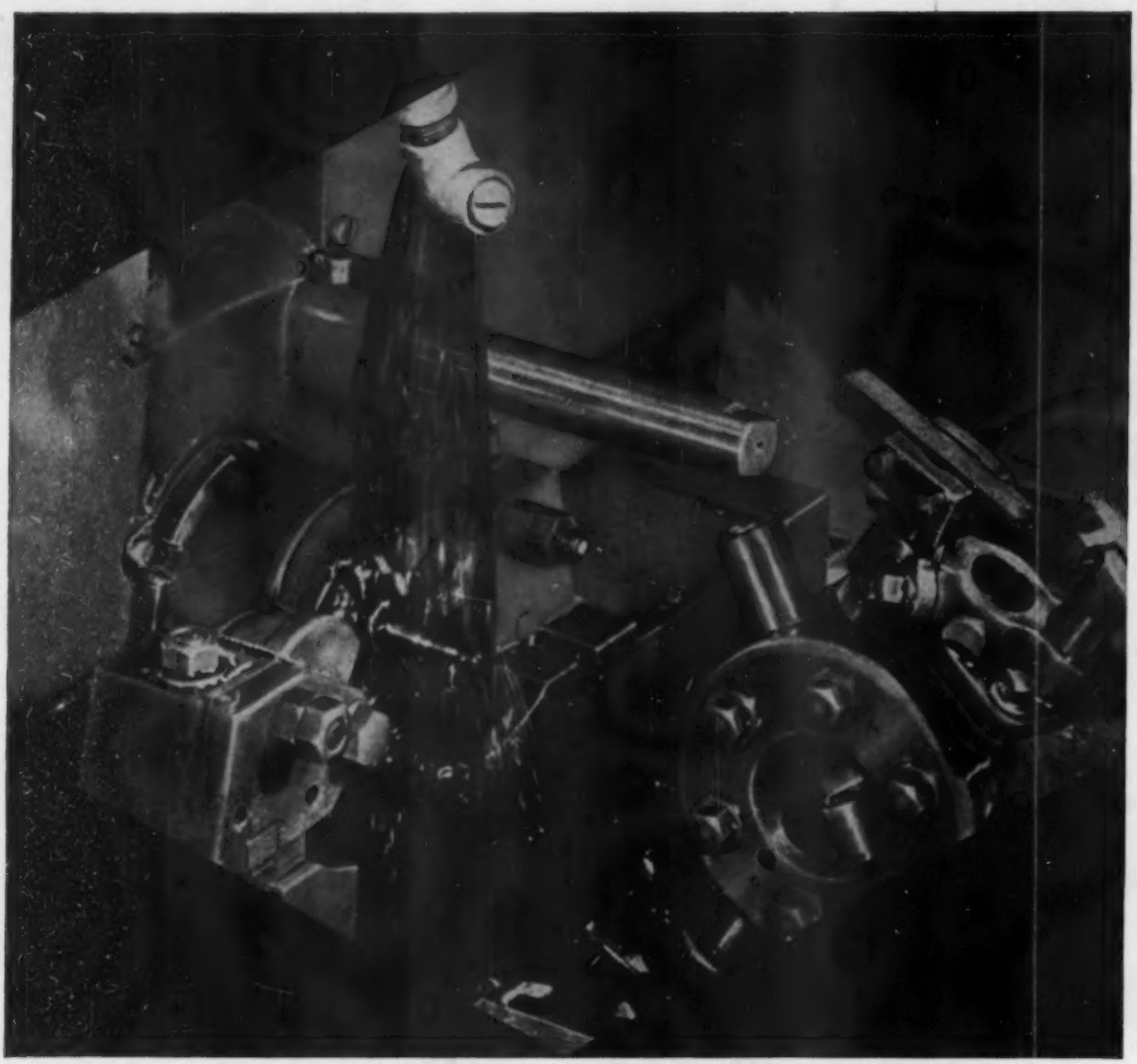
Complete electric generator in vapor phase of Trichlor solvent.

Columbia-Southern Trichlor safely removes contaminants, yet protects the equipment with its heavy-duty neutral stabilizing system.



Rebuilt power units leave Ready-Power in first class condition; all defective parts repaired or replaced, and carrying the same warranty as new units.

Peter Balysh (right) of Ready-Power, and Rodger Lau, Columbia-Southern Trichlor Distributor, inspect soil conditions on a unit turned in for repair.



Replace those black, sulfurized oils! Get cooling, cutting properties you need in a transparent Sunicut cutting oil that lets operators *see* tools, workpieces, finishes and micrometer readings. Sunoco has a wide range of high quality, non-emulsifying Sunicut cutting oils for general-purpose or special-problem operations. They pump easily, wet metal fast, have high film strength, will not stain operators' hands or clothing.

You'll see more than just the job...with Sunicut

SUNOCO

QUALITY...

THE BEST ECONOMY OF ALL

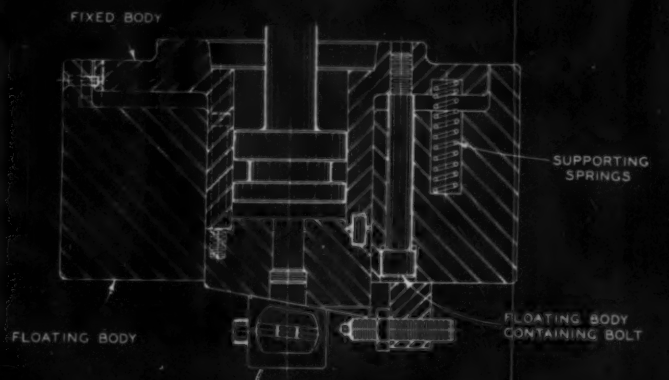
You'll see significant savings, too, when you switch to a transparent Sunicut cutting oil. For you will get the exact *quality* you need for your operation . . . *job-fitted* by men who know what they are doing . . . teamed with *service* you never have to ask for twice.

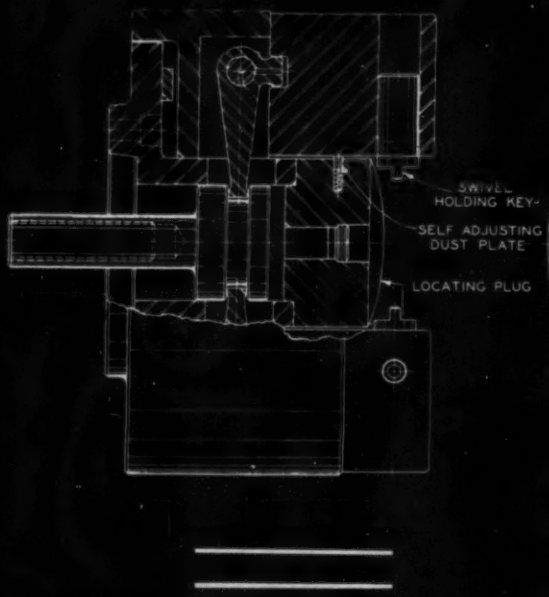
Let a Sunoco representative get you started with a Sunicut cutting oil now. The dividends in extra performance and savings will prove how right you were in investing in Sunoco quality.

Sun Oil Company, Philadelphia 3, Pennsylvania, Department AM-5
In Canada: Sun Oil Company Limited, Toronto and Montreal.

PIONEERING PETROLEUM PROGRESS FOR 75 YEARS

Special CHUCKS

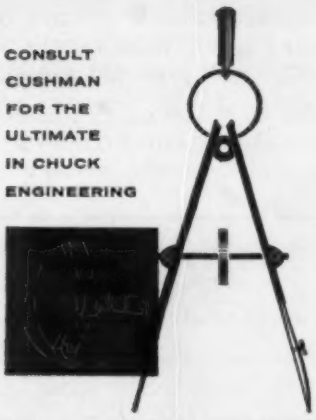




The assembly print reproduced above is but one of many examples of special chucks designed and engineered to meet most unusual workholding and machining requirements. Cushman Special Chucks are being used in many diverse industries enabling manufacturers to meet realistic production quotas, maintain close tolerances, and achieve lowest costs on both short or long runs.

If you have a workholding problem, consult Cushman. Your problem may have already been solved.

CONSULT CUSHMAN FOR THE ULTIMATE IN CHUCK ENGINEERING



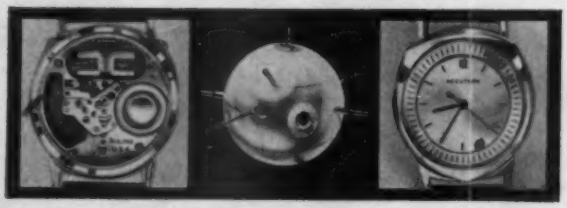
THE CUSHMAN CHUCK COMPANY • HARTFORD 2, CONNECTICUT

Manufacturers of Air and Manually Operated Chucks, Power Wrenches, and Face Plate Jaws.

CIRCLE 188 READER SERVICE CARD

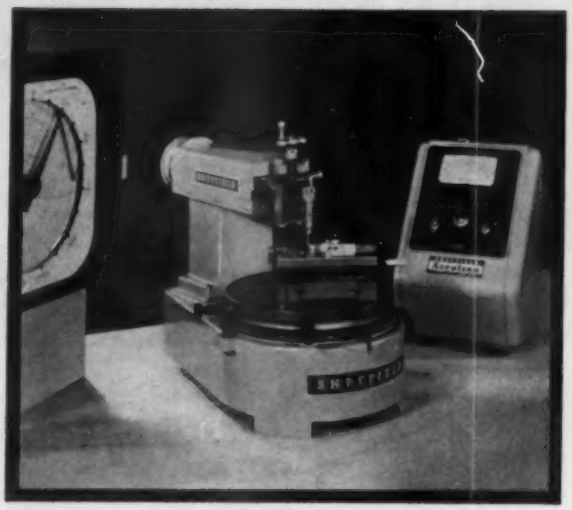
THIS IS ACCUTRON†®

† TIME-KEEPING Great interest has been focused on the new Bulova ACCUTRON timepiece, a watch described by Bulova as "the first instrument of the space age you can wear and use! . . . It doesn't even tick. It hums! First timepiece guaranteed accurate on your wrist." "Accutron" is Bulova's trademark for timekeeping devices. It stands for new standards of accuracy.



® GAGING We welcome Bulova's use of the word "Accutron" as a compliment to the term already distinguished in the field of precision measurement. "Accutron," a Sheffield trademark for gaging devices, has long been a symbol of unquestioned accuracy and reliability. The Sheffield Accutron amplifier, for example, can show dimensions down to two and a half millionths of an inch, and is readily adaptable to an almost unlimited range of electronic gaging heads and tooling, for checking almost any dimension, shape, or relationship. Feathertouch gaging heads (with pressures as low as 5 grams) permit reliable measurements of soft or easily distorted parts. Accutron instruments are in constant service in Sheffield's own Eli Whitney Metrology Laboratory.

Your Sheffield representative can give you prompt competent technical assistance in any phase of your gaging needs. Write for the Sheffield catalog on ACCUTRON gages and accessories.



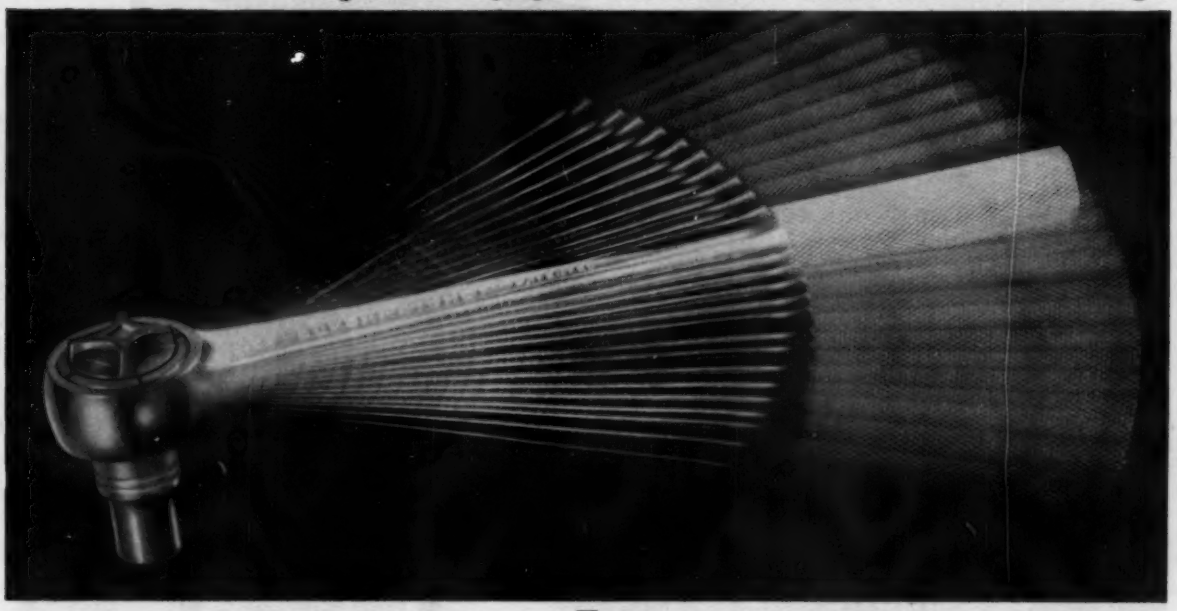
The **SHEFFIELD** *Corporation* *Dayton 1, Ohio*

A subsidiary of The Bendix Corporation

Inspection Gages, Dimensional Control Instruments, Machine Controls, Automatic Gaging & Assembly Systems, Measuray® X-Ray Thickness Measuring, Crushtrue® & Multiform® Grinders, Cavitron® Ultrasonic Machine Tools, Press-Pacer® Transfer Units, Large Dies, Tooling, Contract Manufacturing.

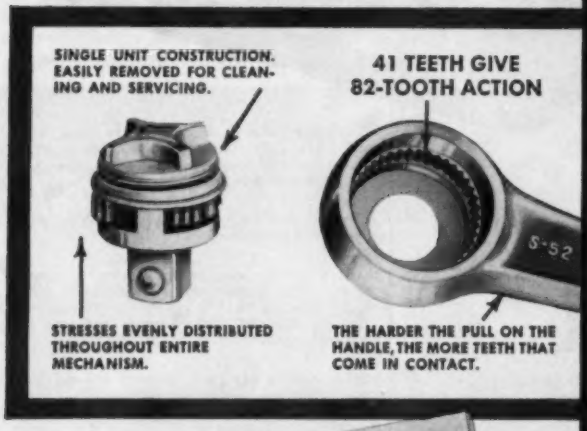
Get the swing with WILLIAMS ⅜" and ½" diameter *SUPERRATCHETS*®.

Complete nut rotation requires less than 4½° swing. Long handle is proportioned for ideal balance, comfort and leverage.



Get the features

Modern design and manufacture combine to produce a ratchet 50% stronger than U.S. Government requirements with these quality features:


SINGLE UNIT CONSTRUCTION. EASILY REMOVED FOR CLEANING AND SERVICING.
41 TEETH GIVE 82-TOOTH ACTION
S-52
STRESSES EVENLY DISTRIBUTED THROUGHOUT ENTIRE MECHANISM.
THE HARDER THE PULL ON THE HANDLE, THE MORE TEETH THAT COME IN CONTACT.

Get the flexibility

88 Drivers and attachments in ¼", ⅜", ½", ¾" and 1" drive sizes, plus 254 sockets, offer endless combinations to solve any nut-turning problem.

GET THE FACTS... GET TOOLFACTS... MR. WRENCH

suggests that you send for this New 24-page booklet on How to Select, Use and Care for Quality Wrenches.

J. H. WILLIAMS & CO., 408 VULCAN ST., BUFFALO 7, N. Y.
Division of United-Greenfield Corporation

Mr. Wrench: Please send me your new
☐ TOOLFACTS Booklet ☐ ILLUSTRATED CATALOG No. 304

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NEW

CAGEROL®

CAGE TYPE
HEAVY DUTY
NEEDLE ROLLER
BEARING

BY McGILL®

INCREASE EXPECTED LIFE UP TO 10 TIMES!

You need CAGEROL bearing performance if higher speeds and increased misalignment have prevented the utilization of needle bearing load capacity in your applications. Most important, CAGEROL bearings can deliver up to 10 times more expected life where misalignment and increased speeds exceed the capabilities of ordinary and guided needle bearings. The difference is in the exclusive McGill construction that features tapered retainer pockets for balanced roller guidance, crowned rollers, and black oxide retainer finish. CAGEROL bearings are interchangeable with all heavy duty needle roller bearings — with or without inners in two bore sizes.

McGILL MANUFACTURING CO., INC., Bearing Division
300 N. Lafayette Street, Valparaiso, Indiana

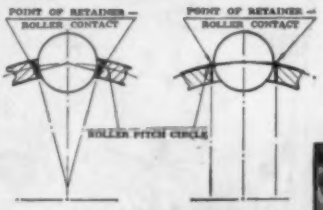
1 Exclusive crowned roller construction, electronically gauged to insure precision contour and size uniformity. Relieved ends assure even load distribution.

2 Flat ends fully engage integral race shoulders, provide maximum support.

3 Proper guidance assured by tapered retainer pockets. The design insures *balanced* roller support and eliminates corner wear from edge loading of straight pockets where retainer OD and pitch circle are coincident.

4 Simultaneously punched pockets assure accuracy of race and roller alignment. The black ferrous oxide retainer finish absorbs and retains lubrication, reducing the friction coefficient.

5 SAE 52100 steel outer race has optimum hardness and surface finish.



Ask for Bearing Catalog #52-A.

engineered electrical products

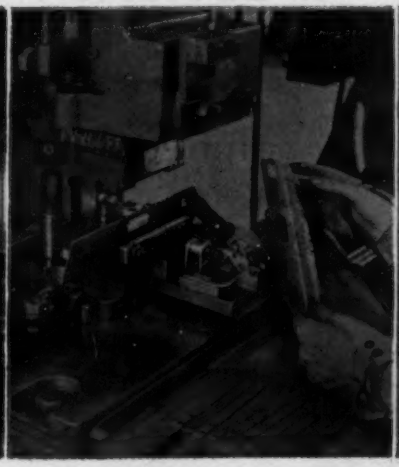
McGILL®

precision needle roller bearings

39 OBI'S GIVE PRESS DOLLARS 3-WAY STRETCH

Newly installed Niagara Inclinables provide required precision at lower investment, produce more parts per hour, and cut maintenance to the bone

SERVING ONE OF THE WORLD'S LARGEST typewriter manufacturers in a brand-new plant, 39 new Niagara Series A Open Back Inclinables play a key role in the production of nearly 2000 precision parts for portable machines. With selection based on past experience, these presses are more than living up to expectations . . . performance-wise and dollar-wise.



.001" TOLERANCES ARE MAINTAINED as Niagara OBI's engage in a wide variety of piercing, notching, trimming, bending and intricate forming operations. Here, a hinge tab is given a final bend on a 22-ton Niagara Series A. Rigid press frames and short-coupled, multiple "V" gibs not only insure precise production, but lengthen die life.

BOOSTING PRODUCTION 30%, these fast-acting hand fed OBI's turn out an average of 1300 pieces an hour per machine. The reason: Instant clutch engagement and disengagement at every press stroke provide more working strokes per minute. Niagara's famed multi-point mechanical sleeve clutch picks up the load on 14 engaging jaws and applies driving force concentrically without keys or pins.

EVERYTHING HUMS ALONG SMOOTHLY day after day. Niagara OBI's are unmatched for dependability and safety. With fewer parts and simpler construction, there's less to go wrong . . . less to repair and replace. No complicated electrical circuits, limit switches or solenoids . . . no palm buttons, air valves or rotary connections.

MAINTENANCE IS SHAVED TO AN "ABSOLUTE MINIMUM" according to this Niagara user. Unlike other presses previously utilized, these Series A's do not require constant "doctoring." There's no need for frequent adjustment of the clutch sleeve and brake. No "dogs" to break off and require replacement. No press can match its economy.

WANT TO STRETCH YOUR PRESS DOLLARS, TOO? Write for illustrated Bulletin 58 containing the facts and figures on Niagara Series A Open Back Inclinable Presses (built in 13 standard sizes with shaft diameters from 1¼" to 6½" and capacities from 5½ to 190 tons). *Niagara Machine & Tool Works, Buffalo 11, N. Y., District Offices and Distributors Everywhere.*

NIAGARA OBI PRESSES

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work.

CIRCLE 192 READER SERVICE CARD

GUARANTEED ACCURATE

The Most for Your "Rockwell Testing" Dollar!

Clark Hardness Testers are *guaranteed* accurate for all "Rockwell Testing". Clark's exacting workmanship in the production of penetrators, testing blocks, anvils, and other accessories pays off in exceptional accuracy on the job. No wonder the low cost surprises our first-time customers. *Clark Instrument, Inc., 10201 Ford Road, Dearborn, Mich.*

FREE REFERENCE BOOK

All information about hardness testing in easy-to-read text with many illustrations. Just write "Send Book" on your letterhead. Description and prices for Clark Hardness Tester and free Hardness Conversion Chart also available on request.

CLARK INSTRUMENT, INC.
10201 FORD ROAD
DEARBORN, MICHIGAN

Missile-Age Accuracy

LETTER from the PUBLISHER

Modernization and You

Perhaps you are running a medium-sized shop; maybe one plant in a vast complex of manufacturing facilities making up a large company; or you have responsibility for over-all manufacturing operations at the top management level. Whatever the case, you cannot fail to have a vital interest in the preliminary moves being made by the new administration in the area of special incentive for investment in new, more efficient plant and equipment.

Our campaign . . .

As a reader of AMERICAN MACHINIST/METALWORKING MANUFACTURING, you must be well aware of the campaign we are carrying on (a crusade we have led for better than 50 years) for maximum tax incentive to modernize production equipment in metalworking.

Editor Burnham Finney's recent editorials on tax incentives to modernize represent only our latest effort. (See "An Open Letter to President Kennedy," March 6, 1961, and "Good for the Unions Too," April 3, 1961.)

What you can do . . .

This is a job we cannot do alone. We can editorialize. We can publish our every 5-year Inventories of Metalworking Equipment. We can publish articles that spell out the pros and cons of modernization. We can publish formulas for replacement. In the final analysis, only *you* can tip the scales. There are three things you can do if you *really* believe in modernization:

1. Renew your efforts to sell your management on employing the most up-to-date methods of depreciation now available under the tax law.

2. Write the President, your Senators and your Congressman expressing your views in favor of even more up-to-date tax incentives.

3. If you haven't already done so, start right now to get under way a *program* of modernization and upgrading of your production facilities.

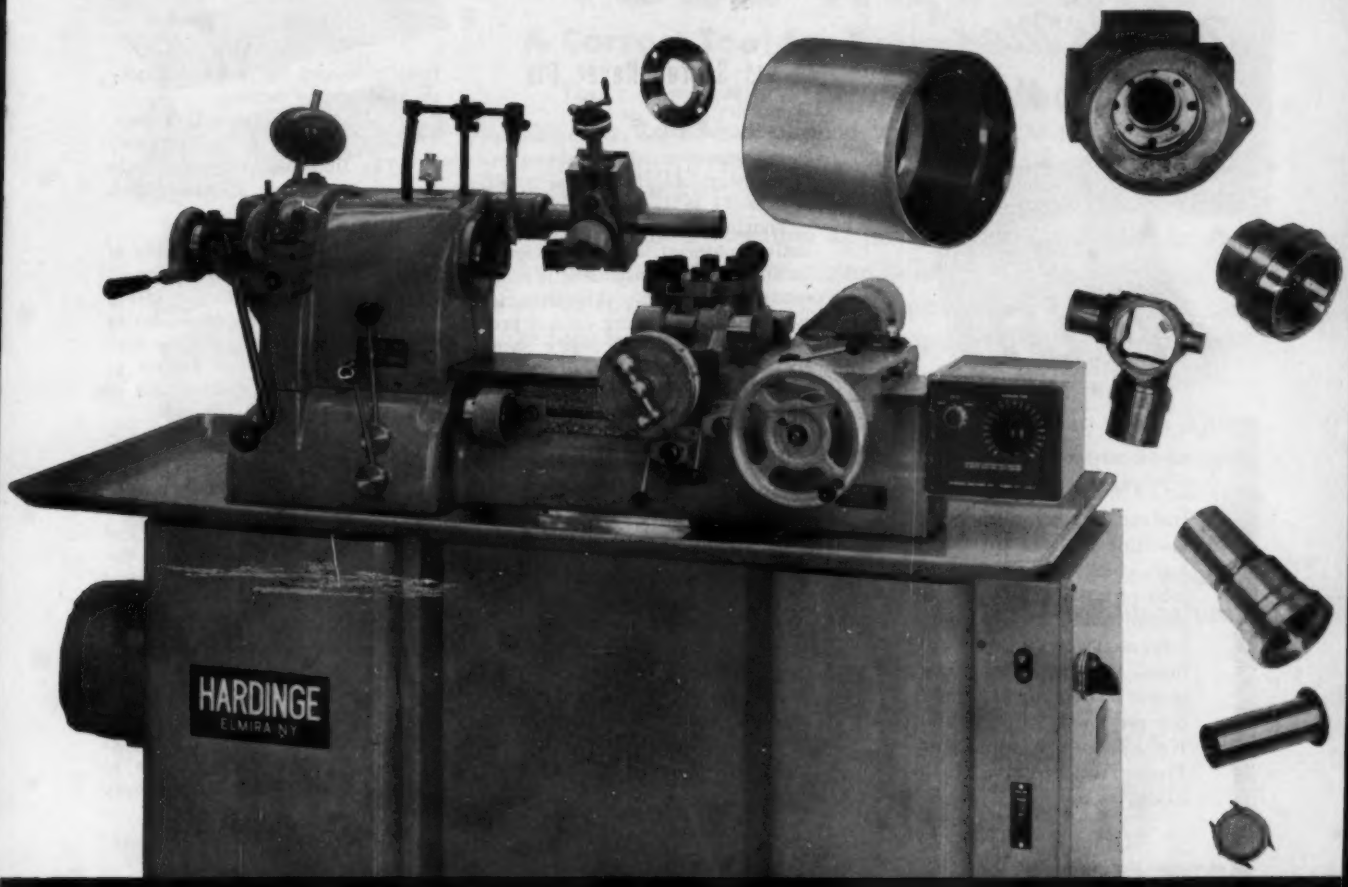
George Reppert

HARDINGE
ELMIRA, N.Y.

PRECISION CHUCKING MACHINE

Users say:

"We now get Production with Tool Room Accuracy"



Users enthusiastically tell us how they can easily maintain close tolerances, get better parts finish, and at the same time substantially cut costs . . . when they put Hardinge High Speed Precision Chucking Machines to work.

These results are possible because parts are finished in one setting with simplified tooling. All parts shown were produced with standard tool bits.

1 1/16" Collet Capacity— 6" Chucking Capacity— Write today for Bulletin HC-HCT which presents the whole story.

Offices in Principal Cities
Export Office: 269 Lafayette St., New York 12, New York.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

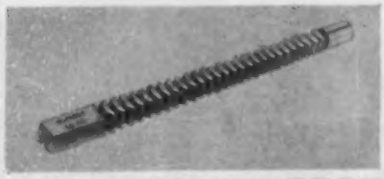
When Any Way of
CUTTING KEYWAYS
but
Minute Man®
Costs Too Much

Minute Man Keyway Broach Kit

Instead of setting up a big machine tool for the small but constantly necessary jobs of cutting keyways in gears, hubs, milling, cutters, etc., you can do it, by hand, with an arbor press, in *one minute* for *as little as one cent* with Minute Man Keyway Broaches and Kits. For keyways from 1/16" to 1" in any bore from 1/4" to 3".

◀ Minute Man Keyway Broach

Save Time with Standard Stock SQUARE BROACHES
1/16" to 1" holes
(32nd sizes, too)



The duMont Corp., Greenfield, Mass.
MAIL FREE BROACH CATALOG AND PRICE LIST A describing Square, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....
Company.....
Address.....

duMont

Booth No. 3215, ASTME Show, N.Y. Coliseum, May 22-26

LETTERS

to the editors

330 W 42nd St, New York 36, NY

Old Scares Never Die

Dear Sirs:
Your item on the skin milling of thin magnesium sheet was of interest here (*AM/MM*—Mar 20 '61, p144).

Thorium is a low-level radioactive material, and its presence as an alloying constituent is moderate (3% or less). The shavings generated by milling do not produce particles sufficiently small to be suspended in air, so that internal exposure to radiation from this source would not be a problem.

Dust collecting equipment used with conventional magnesium alloys is sufficient to keep thorium contamination well within safe levels; thus, no internal radiation problem from grinding.

There is no special "explosion hazard," either, when this dust collecting equipment is employed for magnesium-thorium.

External exposure to radiation from the magneisum-thorium alloys is so low that film badges and other monitoring devices are unnecessary. The only real problem of internal radiation is in connection with welding, and this is readily solved by means of not-very-elaborate venting.

Clayton L Dickey,
mgr, Merchandising
The Dow Metal Products Co
Midland, Mich

Even though the article spoke of "explosion and radiation hazard," it also spoke of "simple safety measures," and said, "Samples of the air and dust around the mill have shown that the danger of radioactivity is negligible"—Ed.

Beyond Automation

Dear Sirs:
From time to time a new technical trend or development rises on the horizon and is given some sort of "magic slogan" for a title. Only too often this title then picks up great publicity, and large numbers of people represent the development as a panacea for industry or the public in general.

It is unfortunate that the values of the new development are so often overstated. There are very few panaceas around.

"Automation" is one of the mag-

SHOPMATES

N. Jarvis

IF YOU WANT THAT JOB DONE RIGHT, YOU GOTTA GET A CHIP CLIPPIN' MACHINE.... I HAD PLENTY OF EXPERIENCE RUNNIN' ONE.... IT'LL PAY FOR ITSELF IN A FEW YEARS.... I COULD USE IT ON A LOT OF DIFFERENT JOBS!!
WELL.... IT WON'T BE EASY GETTING THAT MUCH MONEY.... THE BRASS IS VERY STRICT....
....CHIP CLIPPER CAME HUH.... GOOD DEAL.... WELL.... SO LONG! I BEEN TRANSFERRED TO MY UNCLE BERT'S DEPARTMENT.... MAYBE SOME DAY YOU'LL COME ACROSS A GUY WHO CAN RUN THAT THING!
DELUXE CHIP CLIPPER
SHAKE RATTLE AND GOUGE TOOL CO. INC.
N. JARVIS

ARMSTRONG
TOOL HOLDERS
A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with *adequate numbers* of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for *every* standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

Check over your ARMSTRONG Tool Holder needs.
Write for literature.

If you do not know the name of your local ARMSTRONG Distributor, inquire when asking for literature.

See us at Booth #3906
ASTME SHOW
New York Coliseum

ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. CHICAGO 46, ILL.

Snap-on

Industrial Sockets

BUILT EXTRA TOUGH... to take a beating

Just ask a SNAP-ON sales engineer about companies that have cut socket breakage and increased output by switching to SNAP-ON. These built-to-take-it industrial sockets have the extra heft, accurate dimension and special steel toughness to stand up to day-in, day-out production and maintenance work. Result: more work hours per socket — far less downtime due to socket failure.

Wide range to fit your needs!

SNAP-ON sockets are built in a wide range of sizes in ¼-in., ⅜-in., ½-in., ¾-in., 1-in., 1½-in., 2½-in. and 3½-in. square drive. Socket varieties include standard lengths, bolt clearance lengths, thin-wall types, magnetic sockets; special shapes for self-tapping screws and tapered hex nuts; semi-flexockets and full flexockets; plus a full range of extensions and handles.

Talk sockets with your SNAP-ON man. He's a tool specialist who can offer competent advice on what's best for you in SNAP-ON's complete range of industrial sockets. Be sure to specify if sockets are for hand use or for power nut running or for power impact use. SNAP-ON makes different sockets for all these uses.

Service as near as your phone!

SNAP-ON industrial wrenches and mechanic tools are quickly available from stock warehoused at regional industrial and branch sales offices. You get fast action on regular or emergency needs. Write now for new 180-page industrial catalog.

FOR ALL INDUSTRY

SNAP-ON TOOLS

8025-E 28th AVENUE • KENOSHA, WISCONSIN

ic slogans that have appeared in recent years, even though this same concept is quite old technically. In industries where the manufacturing process is primarily mechanical, the name automation has essentially been substituted for process engineering.

One of the problems associated with the automation trend has been that changes in the end product obsolete not just a single machine but a complete production system and thereby great'y increase the capital investment required for model changes.

This has lead to considerable thought about the need for machines that lend themselves to automatic production but are less likely to become obsolete.

It is important to move forward, not under the banner of automation, but rather under a concept of *systems engineering*, which says that a production system, while being a totally engineered system, is not necessarily automatic.

In any case, it must fit the needs of the business in an over-all sense, including such factors as capital investment, flexibility, unit manufacturing costs, and capacities. Its components would then need to be compatible with the general system requirements.

This approach should help prevent our substituting automatic flow processes for batch processes when the latter processes have an advantage from the viewpoint of the over-all system. The tendency is to fall into the trap of assuming that automation is the only way.

Hamilton Herman, *vice pres & dir*
Research & Development
American Machine & Foundry Co
New York, NY

AM/MM

"All right, let's hear your wild excuse for tardiness this time."

CALENDAR

American Foundrymen's Society —Castings Congress and Exposition, May 8-12, Brooks Hall and Civic Auditorium, San Francisco, Calif.

National Industrial Production Show of Canada — May 8-12 Canadian National Exhibition Park, Toronto, Ont.

Material Handling Institute — Eastern States Show, May 9-11, Convention Hall, Philadelphia, Pa.

American Society of Mechanical Engineers — Production Engineering Conference, May 10-12, Royal York Hotel, Toronto, Ont.

American Institute of Industrial Engineers — National Conference and Convention, May 11-13, Sheraton-Cadillac, Detroit, Mich.

Machinery Dealers National Association — Annual Convention, May 15-18, Shoreham Hotel, Washington, DC.

American Society for Quality Control — Annual Convention, May 22-24, Sheraton Hotel, Philadelphia, Pa.

Design Engineering Show, May 22-25, Cobo Hall, Detroit, Mich.

American Society of Tool & Manufacturing Engineers — Tool Show, May 22-26, Coliseum, New York, NY.

American Supply & Machinery Manufacturers Association — Triple Industrial Supply Convention, May 23-25, Atlantic City, NJ.

Canadian Purchasing Conference, May 29-30, Royal York Hotel, Toronto, Ont.

American Gear Manufacturers Association — Annual Convention, June 4-7, The Homestead, Hot Springs, Va.

Society of Automotive Engineers —Summer Meeting, June 4-9, Chase-Park Plaza Hotel, St Louis, Mo.

Drop Forging Association — Annual Meeting, June 14-17, The Greenbrier, White Sulphur Springs, W Va.

MAJOR AIRCRAFT MANUFACTURER MAKES...

Fully Automatic Savings with NELCO TOOLS on Tape Controlled Miller!

PROFILE MILLING AROUND WING SECTION

OPERATION #1

MATERIAL	Aluminum Alloy, Tough & Abrasive.
CUTTER USED	2" diameter, 2 flute NELCO Carbide Tipped End Mill. Negative Helix.
SPEED	3600 R.P.M., 1900 S.F.M.
FEED	20" per minute.
WIDTH OF CUT	1½".
DEPTH OF CUT	5/16 to ⅜ inch.
PRODUCTION	Nelco End Mill conformed to aircraft tolerances and to rugged automated production schedule.

There are 121 Nelco End Mills specially engineered to mill Aluminum.

Machine: Giddings & Lewis, 2 spindle vertical, 100 H.P. each spindle, tape controlled

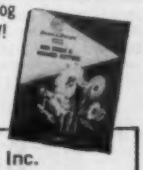
FACE MILLING WING SECTION

OPERATION #2

MATERIAL	Aluminum Alloy, Tough and Abrasive.
CUTTER USED	Standard 6" diameter Nelco Face Mill modified with 30° chamfer.
SPEED	3600 R.P.M., 5400 S.F.M.
FEED	80" per minute
WIDTH OF CUT	6"
DEPTH OF CUT	¼ to ⅜ inch.
PRODUCTION	2 cubic feet of metal removed in 20 minutes. 6 pieces per grind—12 cubic feet of metal removed per grind.

Again, NELCO Carbide Tipped Tools prove their economy and dependability. NELCO manufactures the most complete line of Carbide Cutting Tools engineered to mill ALUMINUM. They are available through your Local Distributor.

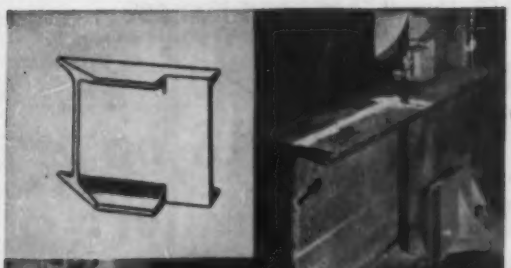
Send for the NELCO Catalog today!



For that EXTRA Edge in Production!

NELCO

NELCO Tool Co., Inc.
Subsidiary of:
Cutting Tool Division
Brown & Sharpe Mfg. Co.
Providence 1, Rhode Island



COPING AND MITERING HEAVY STRUCTURAL SHAPE

18" Beam (above) is held between vises for the short cut. On the long cut (left) vises were removed and beam held by simple clamp. The MARVEL Band Saw is truly indispensable in ornamental and structural iron shops where this type of work is done daily. The machine will cut-off square, miter and cope any work shape from the smallest moulding to 18" I-beams.

SPLITTING CLAMP RINGS, BUSHINGS

Splitting clamp rings, connecting rods, bushings and collets is a fast, simple operation on the No. 8 Band Saw. Perfect control, quick chucking facilities, accuracy and speed are features that especially fit the machine to handle this type of work.

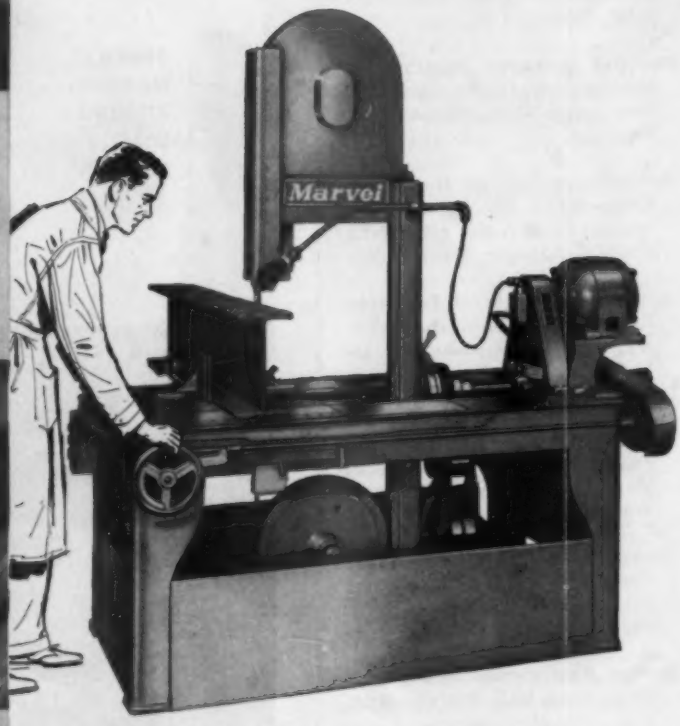
MITERING LARGE DIAMETER PIPE

Pipe (or any bar shape) may be mitered at a 45° angle without the need for special jigs or fixtures. Even when cutting miters, work remains in the same position as it does for straight cuts. Column and blade are instantly tilted to desired angle, even without stopping the machine. Perfect miters (or lesser angles) are sawed without any layout or special equipment.

SEGMENTING LARGE DIE BLOCK

Three equally spaced re-entrant cuts were made in this 16" x 18" SAE 4130 Forging. Job was completed, floor-to-floor in 5 hours. No special jigs or fixtures were required. An unusual job that serves to emphasize the versatility of the MARVEL No. 8 Saw.

"The One Machine We Couldn't Do Without"



"As simple to use and handy as a Scout Knife" is the way another user described his MARVEL No. 8 Universal Band Saw recently . . . and we can't think of a better way to describe this versatile metal cutting machine.

With a MARVEL No. 8 Band Saw, you can do almost any conceivable straight, angle, or miter metal sawing job—from cutting-off bar stock to making the most unusual forming cuts. You can handle small, delicate work, and in the next minute, saw structurals, or segment large work as illustrated in the lower photograph. You will save time, labor, and material with a MARVEL No. 8 Band Saw because no other saw has all the features to be had in this truly universal tool.

Upright column design and forward travel of the blade through the work (which remains stationary on the table-height saw bed) provides easy, unobstructed visibility and more convenient and efficient working conditions; column can be tilted and locked at any angle up to 45° left and right of vertical; the exclusive MARVEL Power Feed with Automatic Overload Relief; Automatic cutting-depth stops; simple, convenient operating controls—these are some of the features which make the No. 8 Band Saw the most useful—and used—metal cutting saw on the market.

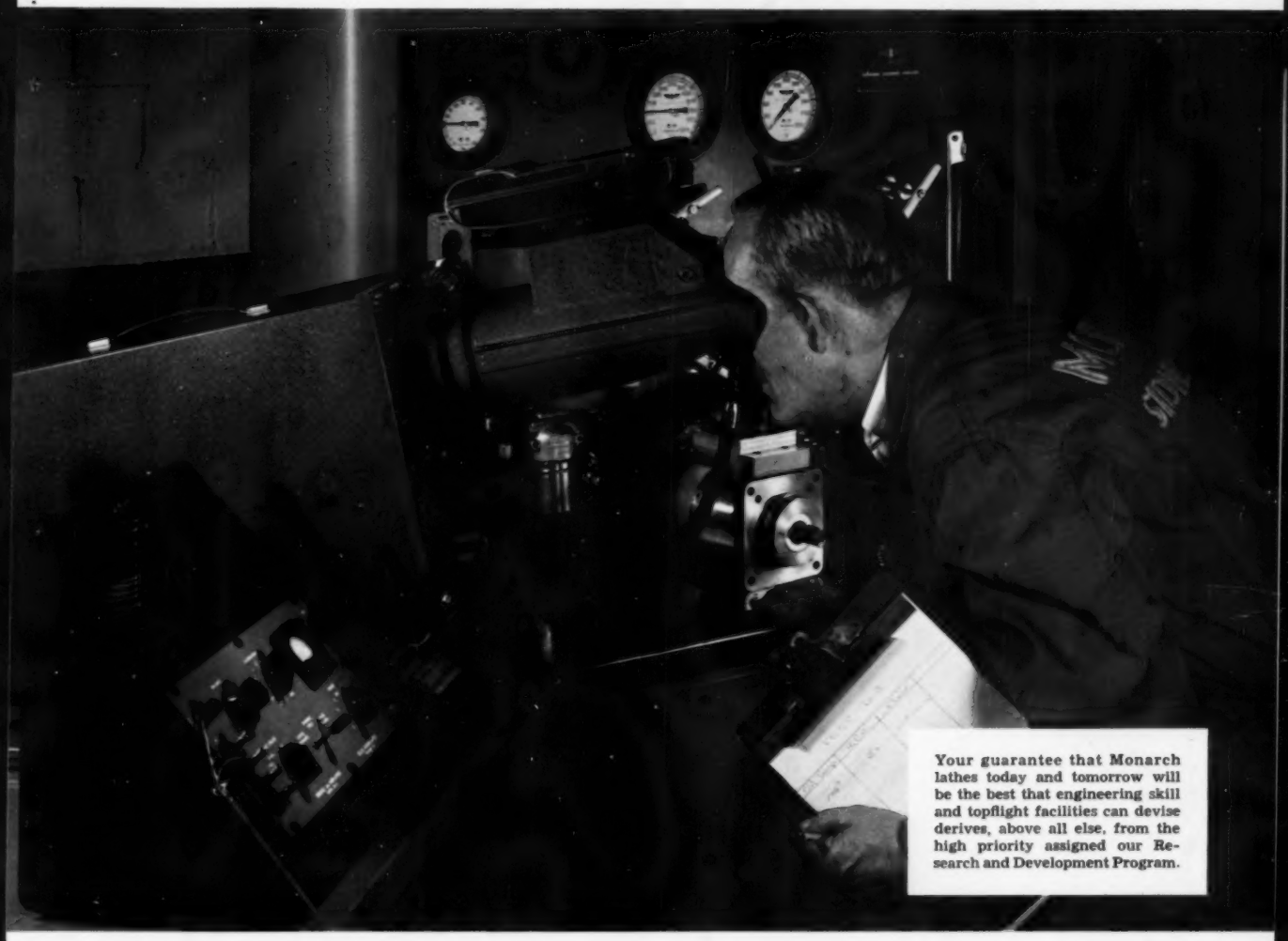
For the complete story, ask or write for Bulletin 875 which illustrates and describes MARVEL Universal Metal Cutting Band Saws.

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 W. BLOOMINGDALE AVE. • CHICAGO 39, ILL.

421

He's making a Monarch Lathe...



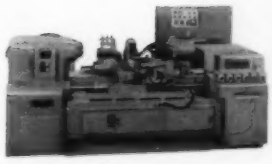
Your guarantee that Monarch lathes today and tomorrow will be the best that engineering skill and topflight facilities can devise derives, above all else, from the high priority assigned our Research and Development Program.

One example of where the extra values come from—in your MONARCH Lathes

Gauging lathe values is as important to you as gauging lathe quality is to us—same coin, both sides. Spending the fewest dollars on a machine tool is far from getting the biggest dollar's worth, of course.

Witness this hydraulic motor check, one of the thousands of checks and tests conducted each year in our Research and Development Laboratory to meet our unique research, development and quality control objectives. Or should we say "our goals of higher productivity, greater accuracy and optimum dollar value to the user?" Same thing.

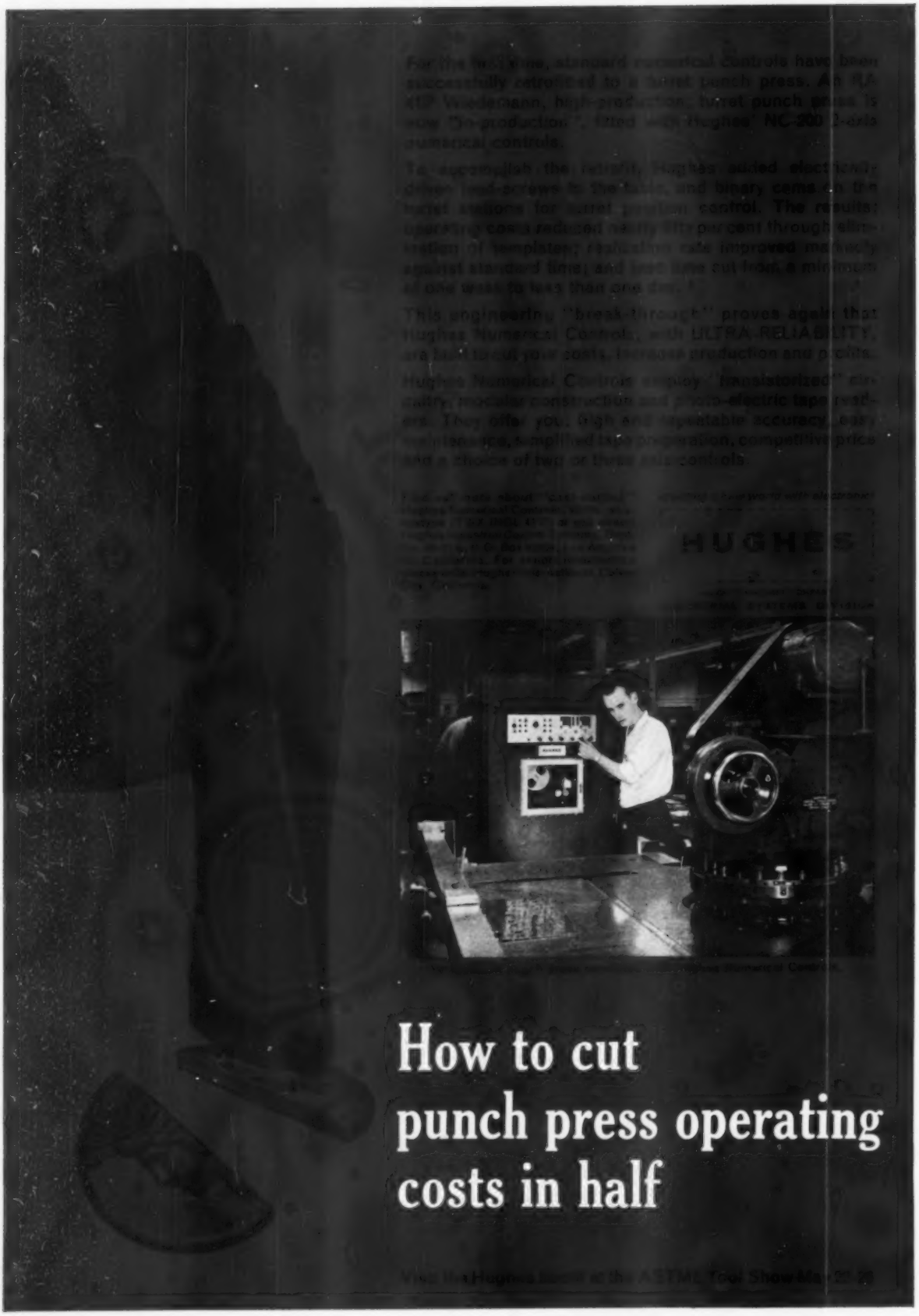
It is in the sum total of many procedures like these in both engineering and manufacturing, many exclusive with us, that you find the true value of the Monarch Lathe. And that can be concretely expressed this way: *in our Turning Clinic today —using your parts—we can demonstrate Monarch lathes that will increase production, reduce or eliminate finishing, lengthen tool life.* Isn't performance like that the ultimate bargain? Write: THE MONARCH MACHINE TOOL CO., SIDNEY, OHIO.



WHEN YOU BUY VALUE
MONARCHS COST LESS

Monarch
TURNING MACHINES

VISIT MONARCH—*We'll turn your part to return you profit*


How to cut
punch press operating
costs in half

SPOT NEWS...

- **Metalworking companies expect their sales to rise 7% to 22% in 1961-1964,** according to the latest McGraw-Hill survey of capital spending plans. The automotive industry anticipates a sales growth of 28% in this period; machinery, 24%; fabricated metals and instruments, 22%; electrical machinery, 20%; and transportation equipment, 7%. See page 80 for more details.

- **Abrasive compounds containing man-made diamonds are now on the market.** Previous compounds all used natural diamond powder. Elgin National Watch Co's Abrasive Division (Elgin, Ill) buys the diamond powder from GE's Metallurgical Products Department in –325 mesh. It is then further ground by Elgin to grades ranging from 54 to 3 microns, and mixed with a petroleum based vehicle of secret formulation. A 10-karat supply sells for $33.50 in any mesh.

- **New orders for machine tools in March hit the highest level in four years.** Metal-cutting tool orders ran to $54,650,000; forming tools to $14,900,000. See pages 61 and 79 for full details.

- **10-year guarantee of accuracy to millionths of an inch** on No. 3 Moore jig borers and No. 3 jig grinders is now being made by Moore Special Tool Co, Bridgeport, Conn. Guarantee is retroactive, covering all of these machines already in use. Moore believes that emphasis on superior engineering and workmanship is the only way in which to compete against lower-priced imports.

- **Standards for dimensional metrology and for calibration of measuring systems** are being contemplated by the Mechanical Standards Board of ASA. Action is expected sometime this month.

- **New safety car makes it almost impossible for riders to be seriously hurt** in an auto wreck, according to Liberty Mutual Insurance Co, designers of the new car. The modified 4-door Chevrolet has lap belts and shoulder harnesses on all seats; specially designed capsule chairs up front; flexible steering shaft; a small-diameter steering wheel that telescopes into the steering tube in a crash; a CO_2 system that smothers engine fires.

- **New orders rose 15.3% for West German sheet and metalworking industries** in 1960. Supply managed to keep pace with demand, but the critical labor shortage prevalent throughout German industry was reflected in the extension of delivery times by an average of fourteen days.

- **Nation's first experimental continuous-casting steel plant for production scale** operation is to be set up under agreement signed by Babcock and Wilcox (NY) and Roanoke Electric Steel Corp (Roanoke, Va). Plant is designed to cast square bars in sizes from three to six inches. Process involves pouring a continuous ingot from the top of a 75-ft-high tower. Roanoke will operate the plant, providing facilities for B&W's continuing process study.

- **Operating costs are lower in small, privately owned tool and die shops** than in large, captive shops, according to William A Paton and Robert L Dixon, of the University of Michigan. In "Make-or-Buy Decisions in Tooling for Mass Production," just published by the U-M Bureau of Business Research (36 pp, $2), they point out that overhead rates in large captive shops may be so high that overall hourly cost of production may be double that in a job shop.

- **Hindustan Machine Tools (Bangalore, India) set a production record in March** of this year when it turned out 131 machines. The government-owned plant has been maintaining production of over 100 machines a month since last September. An expansion program is now under way at this plant.

what shape are your files in?

Shape is as important as length, kind of teeth or degree of coarseness in selecting the right file for each job. That's why there are literally dozens of different shapes among the more than 6000 files in the Nicholson or Black Diamond line. The most basic cross-sections are shown above.

Now's a good time to check your supply of files—and the shape it's in...a good time to replace worn files and obtain additional file "shapes" so that you'll always have the right Nicholson or Black Diamond file for each requirement.

Your distributor* will be glad to suggest a sound file selection for your particular needs. Call him today.

*Industrial Distributors provide the finest goods and services in the least possible time. Our products are sold exclusively through them.

Nicholson File Company, Providence 1, R. I.
Files • Rotary Burs • Hacksaw and Band Saw Blades • Ground Flat Stock • Industrial Hammers

NICHOLSON

WASHINGTON...

Kennedy proposes tax credit . . .

The Kennedy administration program of tax incentives to spur plant modernization is aimed at putting from $2 to $3 billion a year into new tools of production.

The plan is basically simple: A tax credit which would permit companies to cut their corporation tax payment in a given year by as much as 30%.

Growth industries engaged in precision equipment modernization are precisely the kind that should benefit most from the new program. The President emphasizes that the purpose of the incentive is to modernize plant and equipment; capital investment in used plant and equipment doesn't qualify.

"High capital formation can be sustained only by a high and rising level for goods and services," Kennedy says. "Rather than delaying the program's adoption until all excess capacity has disappeared and unemployment is low, we should take this step now to strengthen our anti-recession program, stimulate employment and increase our export markets."

He estimates that a half a million jobs would be created by a full year's operation of the program, stemming from the additional expenditures "in the capital goods industries."

Why a tax credit?

The President made the decision to recommend the tax credit method proposed by Assistant Secretary of the Treasury Stanley S Surrey.

Kennedy's reasons: More rapid depreciation shares some of the advantages of the tax credit proposal, but he finds the investment credit superior for a number of reasons. He argues that proper methods of depreciation have a normal and important function in determining taxable income, apart from incentive considerations.

"It may be that on examination some of the existing depreciation rules will be found to be outmoded and inequitable," his message to Congress reads. "But that is a question that should be separated from investment incentives."

Indeed, a review of depreciation is underway at the Treasury, and adoption of the proposed incentive credit would in no way foreclose later action on these aspects of depreciation—that is, shortening the taxable life of capital goods.

The investment credit, Kennedy claims, induces more new investment for the same revenue loss to the Treasury.

How it works . . .

The tax credit plan would work like this: A small metalworking firm spending $5000 on new equipment could subtract 10% of this, or $500, from the tax bill it would otherwise pay. (The 30% maximum credit, however, would mean that the firm would have to have a tax bill, before the credit, of around $1700. If tax liability should be only $1000, before credit, under the same set of circumstances, the firm would be entitled only to 30% of $1000, or $300 as a credit).

A larger manufacturer that spends $60,000 for new equipment in one year with a depreciation allowance of $100,000, would benefit thusly: It would get a 6% credit for the $10,000 of investment over 50% of its normal depreciation allowance of $100,000. So this firm would have a tax credit of $600 plus the $500 based on 10% of the first $5000 of spending, or a total tax credit of $1100.

The larger company that spends, say, $2 million for new plant in any given year, and has a depreciation allowance of only $1 million would get this treatment:

First off, it would get a $500 credit on its first $5000 of spending. Then it is entitled to 6% of the amount that falls between 50% and 100% of its depreciation allowance—$30,000. Then it adds 15% of the excess of its spending over its total depreciation allowance—15% of $1 million, in this case, or $150,000. Adding all these together—$500, $30,000, $150,000—the company cuts its tax payment by $180,500.

Again, this assumes that the firm makes profits large enough during this year—roughly $600,000—so that its $180,500 falls within the 30% maximum limitation.

Kennedy's adoption of the tax credit idea is a clear victory for Assistant Secretary Surrey. Besides Surrey, the Council of Economic Advisers, headed by tax specialist Walter Heller, also favors the tax credit approach.

However, there are other officials inside the administration, and many conservative legislators in Congress, who will favor increased liberalization of depreciation—and they will fight for some depreciation method to be approved.

For instance, Senator George Smathers (D, Fla) criticized the tax credit approach. Smathers called the credit "a type of subsidy which will surely be attacked in the future on that ground . . . its very nature makes it so vulnerable to the charge that it is a handout or a giveaway that no reliance can be placed on its continuance."

The tax credit plan will almost surely be criticized by Walter Reuther, United Auto Workers president. He takes the position that there is no need for incentives to boost plant capacity at a time when so much capacity is idle for lack of consumer demand.

BULLARD REVERSES THE PRICE TREND

with the *NEW* Lower Priced . . . MULT-AU-MATIC, Type "M"

with these features:

- **NEW** Simplified Control
- **NEW** Angular Carrier Chip Guards
- **NEW** Larger Chip Capacity
- **NEW** Index Registry
- **NEW** American Standard Spindle Nose
- **NEW** Double Coolant Seal on Spindles
- **NEW** Design Heavy Duty Clutch and Brake – No Adjustment
- **NEW** Adjustable Power Chucking
- **NEW** Lubrication Filter System
- **NEW** Standard Tooling
- All Bearings and Gears are pressure lubricated
- Easy to Service and Maintain
- Minimum Floor Space
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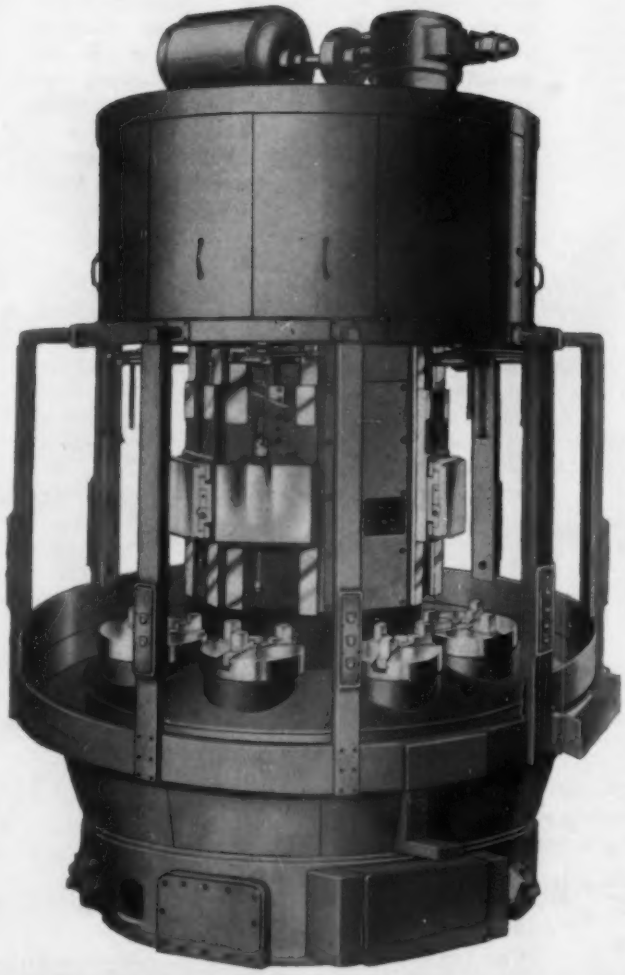
- Uses American Standard Chucks
- Maximum Efficiency



Call your nearest Bullard Sales Office or Distributor, for complete information or write

The Bullard Company
Bridgeport 9, Connecticut

DETROIT...

Production note . . .

Second quarter production schedules, reflecting a growing spring sales surge, have been lifted three times in recent weeks. Current plans call for close to 1,500,000 passenger cars, a healthy total but not equal to the 1,807,000 cars built last year during the period.

Later shutdowns for some makes are forecast. Union sources indicate that Dodge, for example, will close out 1961 production on July 28 and will resume with the new model on August 15. Last year, the dates were July 22 and August 5.

The world is our store . . .

"We are convinced that if all our facilities shop the world for the best value, we can materially increase the competitive efficiency of each company component."

So said Henry Ford II recently before an audience of southern business and civic leaders in Birmingham, Alabama. What Mr Ford means by this major pronouncement is exemplified by the forthcoming Cardinal. Its engine and transmission can be produced more cheaply in Germany, so these units for the U S version will be purchased from Ford's subsidiary in Cologne.

Ford seems alone in the auto industry with this idea. GM Chairman Frederic G Donner stands flatly on his statement of last fall: "General Motors has not been importing components from abroad and has no intention of embarking upon such a program."

AMC's President George Romney has said, "International operations that avoid foreign partnership are unsound, and will ultimately be labeled as imperialism." Ford's overseas activities are for the most part wholly owned subsidiaries.

The UAW-CIO views this matter quite seriously. In a letter to Ford written about a week before the speech, the union's Director of Ford Affairs, Ken Bannon, asks: "Will the introduction of Ford's newest line of compacts increase or decrease employment opportunities in the United States? How? And to what extent?"

Although Ford could not answer Bannon without acknowledging existence of the Cardinal, his Birmingham speech implied that if imported parts could cut the cost of the product, U S workers would benefit in the long run.

Salaries for all . . .

UAW President Walter P Reuther surprisingly points to International Business Machines as an example of the industrial happiness that could be achieved if every worker received an annual salary. It's surprising because IBM is a non-union organization, and the salary policy is designed, in part, at least, to keep unions away.

This is the first indication of the demands auto industry negotiators will face when contract talks begin in July. Along with this, Reuther said he would press the companies for more job opportunities either via the short work week or earlier retirement; extension of supplemental unemployment benefits (SUB) from 26 to 52 weeks and an increase in them from 65% to 80% of normal take-home pay; full company payment of health insurance; a boost in the escalator (productivity) wage formula which now is an annual 6¢ or 2½%, whichever is greater; a voice in the investment of pension trust funds; better working conditions; and some machinery for formal management-union cooperation in solving workers' problems.

The salary demand will probably last as long in serious bargaining as profit-sharing did in the last negotiations; it was not seriously discussed. Extension of SUB is actuarily possible, but companies are anxious to keep the funds full to avoid the required 5-cents-an-hour payment to them. Full payment of health insurance has the precedent of acceptance by Big Steel.

Views on productivity

As to productivity, Malcolm L Demise, VP of Labor Relations for Ford and the company's chief negotiator, recently showed a House subcommittee that the presently committed productivity factor fails to reflect any increase in cars turned out per employee. At Ford in 1950 it was nearly 14 cars per man and remains so now. The union, on the other hand, can argue that cars have become more complicated.

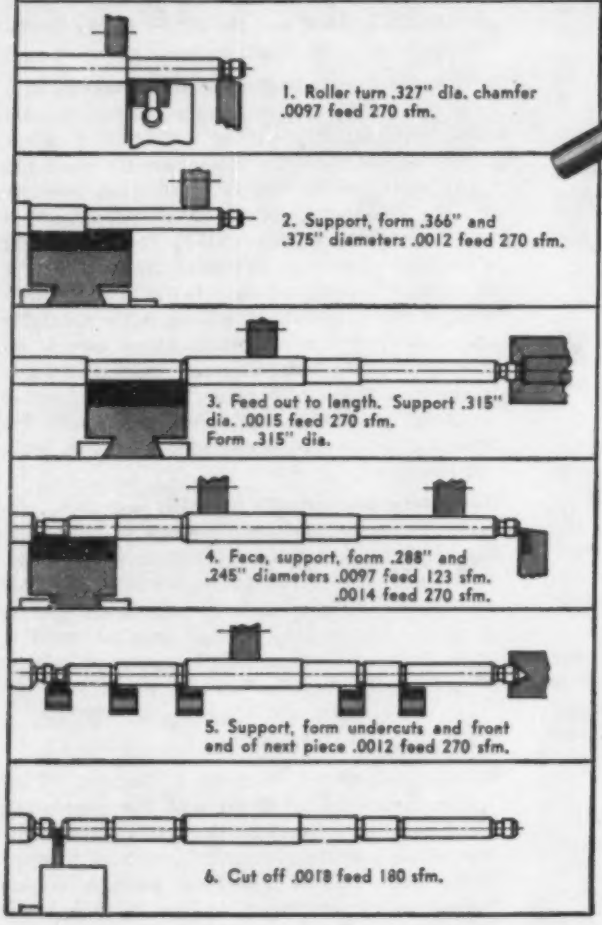
The machinery for formalized union-management cooperation is a desire stemming mainly from retraining problems. Some token cooperation from the auto industry may be granted, but the industry's fundamental attitude was again presented by Denise: "In Detroit," he stated to the House's Subcommittee of Unemployment and Labor, "a study of the trainability of relief recipients has just been completed under the auspices of the Public Welfare Commission.

The committee concluded that a substantial number of those classified as employable and presently receiving relief are not capable of participating in retraining programs of the kind thought of to date."—**Don MacDonald**

GREENLEE AIR-FEED AUTOMATICS BENEFIT "ELECTROLUX" FOUR WAYS . . .

MACHINE . . . 1"-6 Automatic Bar Machine Air-Feed — Feedout on index and in 3rd position during machine cycle.
TOOLING . . . Carbide Tipped
MATERIAL . . . 1137
STOCK SIZE . . . 13/32" rd.

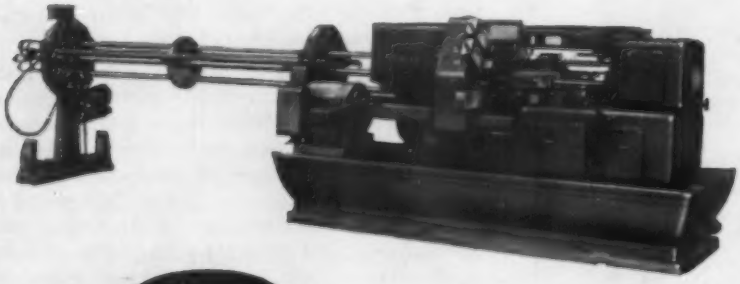
TOOL SLIDE STROKE . . 1-9/16" at .0097" feed.
SPINDLE SPEED . . . 2540 rpm 270 sfm.
MACHINE TIME . . . 5.8 seconds.
ESTIMATED GROSS PRODUCTION . . . 620 per hour


1. Roller turn .327" dia. chamfer .0097 feed 270 sfm.
2. Support, form .366" and .375" diameters .0012 feed 270 sfm.
3. Feed out to length. Support .315" dia. .0015 feed 270 sfm. Form .315" dia.
4. Face, support, form .288" and .245" diameters .0097 feed 123 sfm. .0014 feed 270 sfm.
5. Support, form undercuts and front end of next piece .0012 feed 270 sfm.
6. Cut off .0018 feed 180 sfm.

1. Eliminate stock pushers . . .
2. Eliminate scoring of stock . . .
3. Reduce downtime during set-up . . .
4. Provide extra length feed-out . . .

The part is a 6-7/8" long armature shaft used in the "Electrolux" vacuum cleaner. It demonstrates how effectively Greenlee Air-Feed Automatics and carbide tooling can team-up to increase production and reduce costs. The shaft is machined from 13/32" S.A.E. 1137 steel at a gross production rate of 620 pieces per hour. Recommended cutting speed for high speed tooling is 120 sfm. The rate was boosted to 270 sfm with carbide-tipped tooling. Sequence of operations is shown at the left.

Note how the stock is partially fed out on the index and to its full length in the third position. This provides for the most effective tooling arrangement. Greenlee Air-Feed Automatics permit greater job versatility and assure added profits. See your Greenlee representative or send us a print of your high-cost problem-part.



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PRODUCTION MACHINERY
GREENLEE BROS. & CO.
SINCE 1862
1975 MASON AVENUE
ROCKFORD, ILLINOIS

COMMERCIAL CASTINGS
TRANSFER MACHINES • SPECIAL MACHINES • AUTOMATIC BAR MACHINES • WOODWORKING MACHINES AND TOOLS • DIE CASTING MACHINES • TRIM PRESSES • HYDRAULIC AND HAND TOOLS

AIRCRAFT and MISSILES...

TRENDS

Rapid growth in astronautics . . .

Astronautics is expected to be the biggest field for expansion of aircraft companies in the next five to ten years. A much larger percentage of their operations will be concentrated in space activities in 1965 than now—and even more in 1970 than in 1965.

This long-range planning is supported by decisions coming out of Washington. By far the sharpest increase in defense spending is now scheduled for astronautics. Even before we reach 1970, annual expenditures for space operations are expected to hit $25 billion.

Missile spending will go up, but the curve of dollar outlay per year will be much flatter than that projected for space developments. The reason is simple: We are pretty much over the big hump in development and procurement of new missiles. Anti-missile missiles, however, will be in the forefront of developments.

Outlook for manned aircraft . . .

Don't writeoff manned aircraft. About $5 billion a year now goes into their manufacture. This volume is expected to remain steady, or dip only slightly in the years ahead.

Emphasis will be on the B-70 (despite recent cutbacks), VTOL and STOL aircraft, and ground-effect machines.

Development of supersonic jet transports will be on top of military development. Informed observers see it like this: It will not be financially feasible for the world's airlines to start using supersonic jets traveling 2000 mph until about 1970.

Even then, the world commercial market will be able to absorb only 200 or so such jets, despite the fact that their passenger capacity may not be much higher than that of present Boeing 707s.

New machine tools needed . . .

A lot of money will be spent by the aerospace industry in the next few years for machine tools, much of it for unorthodox machines to do unorthodox jobs.

Aerospace management is not so caustically critical of machine tool builders today as it was a few years ago. It is realized now that builders cannot afford the research and development expenses entailed in certain special machines and then build only one or two such machines.

Much of the production equipment in the aerospace industry ten years from now will be quite different from anything now on the market. And much of it will be developed by the aerospace people themselves.

B-70 status changes again . . .

The revised budget would hurt one major prime contractor, but have little impact on others.

North American Aviation's B-70 program has been hit severely. Previously, programmed expenditures for B-70 development through 1967 totalled $2.7 billion. This has now been cut to $1.3 billion. Expenditures for the B-70 in the coming fiscal year will be cut from $358 to $220 million.

As a consequence, North American's Los Angeles Division will lay off 1200 employees. Some of the loss in expected revenue will be assuaged by President Kennedy's emphasis on Polaris and Minuteman production.

High-energy-rate forming gains . . .

Aerojet-General, Convair, and Ryan report growing interest in high-energy-rate forming. Inquiries received by these contractors in the last six months to a year show a sharp upswing.

In the next few years, these firms believe, HERF equipment will make substantial strides and begin to make inroads into sales of conventional forming equipment. Much of the current flurry of interest in high-energy-rate processes seems to be the result of recent technical sessions devoted to developments in this field. The ASTME, for example, held a seminar on the subject, and several papers were presented during the SAE Aeronautic Meeting.

Convair Astronautics is building an underwater-explosion facility for forming bulkheads, tubing, and ducting for the Atlas ICBM and the Centaur hydrogen-powered space vehicle. This explosive forming technique is reported to have reduced tooling costs by about 40%.

Later this year Convair plans to begin marketing its high-energy-rate Hi-Vo-Pac equipment (AM/MM—Apr 18 '60, p104).

Radiation effects on metals . . .

Convair-Fort Worth is studying the effects of nuclear radiation on titanium, stainless steel, and two aluminum alloys, at temperatures as low as –423 F. The goal is to find a material which can be used in a nuclear engine that will be powered by liquid nitrogen and be subject to radiation.

"The superior quality is evident at first glance . . .

. . . that's why we recently decided to stock ***LUSTERIZED***® *cold finished steel bars"*

SAYS J. T. ERWIN, VICE-PRESIDENT OF ELLIS-ERWIN SUPPLY CO., INC., TAMPA, FLA., who stands in the group at the right with J. E. Ellis, Jr., Sales Manager, W. Gray Ellis, Purchasing Agent and E. C. Cox, Office Manager.

BLISS & LAUGHLIN LUSTERIZED bars are immediately distinguishable from ordinary cold finished steel bars in the racks at Ellis-Erwin, Mr. Erwin reports. Mr. W. Gray Ellis and Mr. Erwin are shown checking the close tolerance and superior finish of a Lusterized bar.

THE SAVINGS that can be realized during production with Lusterized Finish bars are figured by Mr. Erwin and Mr. Ellis.

When a long-established steel service center decides to concentrate on selling a particular line of cold finished steel bars, the bars obviously must be superior.

That is precisely why Ellis-Erwin Supply Co., Inc., Tampa, Fla., selected Bliss & Laughlin Lusterized Finish steel bars.

Mr. J. T. Erwin, Vice-President, writes: "We intend to expand our cold finished sales considerably in 1961. There is a marvelous opportunity in our area with your products. The exclusive quality-pluses and the fast service you render will help us achieve our goal of furnishing the best products to our customers . . ."

This is another example of why more progressive steel service centers stock and recommend Bliss & Laughlin Lusterized Finish bars than any other cold drawn bars.

BL-613

Leading Independent Producer of Cold Finished Steel Bars

BLISS & LAUGHLIN

GENERAL OFFICES: Harvey, Ill. • MILLS: Harvey, Detroit, Buffalo, Los Angeles, Seattle, Mansfield, Mass.

Specialists In Finish, Accuracy, Straightness, Strength and Machinability

CIRCLE 205 READER SERVICE CARD

TRENDS

MACHINE TOOLS...

Biggest month in four years . . .

March was the biggest month in four years for net new orders for machine tools, with a total of almost $70 million. It was a sharp jump from $46.4 million in February.

Automotive orders are reported to have been a sizable factor in the March bulge. Also, export business still is potent. Some $14.3 million out of total bookings of $54.6 million of cutting-type machines, or 26%, were for foreign customers. The ratio was even higher, 28%, in forming-type machines ($4.2 million out of $14.9 million).

About 31% of the dollar volume of net new orders for cutting-type machines came from export sources during the first quarter of '61. Several builders report that half or more of their backlogs consist of foreign business.

Air Force has retrofit program . . .

The Air Force is considering modernizing as many as 55 contouring machines by installing numerical-control equipment on them. Three makes of control systems are said to have AF's blessing. This does not mean, however, that use of other makers' control systems will be barred in future purchases of new machines.

No decision has been made about the amount of money that will be spent by the Air Force for N/C machines desired by contractors. North American wants machines costing $13 million, Douglas $6 million and Lockheed $7 million.

Department of Defense is said to be irked by the fact that certain Air Force people have gone all out in wanting to buy nothing but numerically-controlled machines. DOD points out that there are plenty of spots in which machines without N/C can do a fine job and N/C is not needed.

Export review board created . . .

A Cabinet-level Review Board is to be set up to handle export licenses for machine tools going to Communist countries. Each department head will have a virtual veto power over an export license. Licenses will be issued only after the board agrees unanimously. If any member disagrees, the White House will make the decision.

The board will include the Secretaries of Commerce, Defense and State (or their representatives). Agriculture and the International Cooperation Administration will also be represented. The plan was proposed by Commerce Secretary Hodges.

The new procedure will insure the fact that when a manufacturer gets a shipping license, he will be permitted to make the shipment. It will prevent a repetition of the Bryant fiasco.

Members of Congress who were highly critical of the handling of the Bryant case have expressed their satisfaction over the new setup, which presumably will make it harder to get licenses for machines in what are viewed as particularly sensitive areas.

Simmons outlines surplus plans . . .

Rather than ship government surplus machine tools to underdeveloped countries, they should be sold to small businesses at 25% of the present-day price (which would be more than the original cost), says Charles A Simmons Sr, president Simmons Machine Tool Corp, Albany, N.Y.

Machines would be sold only through dealers in new or used machines. Only registered salesmen would be eligible to dispose of surplus.

Whenever a buyer purchases surplus machines, Mr Simmons' plan specifies that he must destroy equipment of the same weight. Replaced machines would be of the cone-type, belt drive, or machines whose builders went out of business prior to World War II.

Buyers would make checks payable to the government and would receive a 10% commission after shipment. The government thus would receive 22½% of the present-day price. If surplus machines are bought for a new plant or to increase facilities and the buyer has no available equipment to junk, he would be excused from the scrapping provision.

REM to sell Harrison lathes . . .

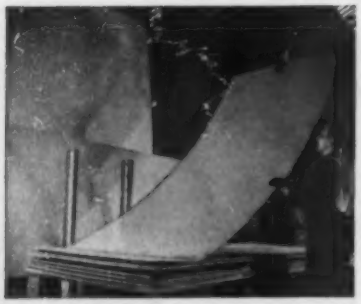
National distribution of Harrison (British) lathes has been taken over by REM Sales Inc, subsidiary of Robert E Morris Co, West Hartford, Conn. U S sales formerly were handled by Clearing Division of U S Industries.

In addition to Clearing-Harrison geared-head lathes, REM will sell through distributors a new combination toolroom and copying lathe designed for the American market and a new Harrison plain horizontal milling machine.

A well-known builder in this country has recently terminated its contract to sell a European machine here. Reasons are: 1) two increases in prices in the past year, bringing the foreign machine's delivered price close to prices of U S machines; 2) long deliveries; 3) unwillingness of European builder to make any changes in design for the American market.

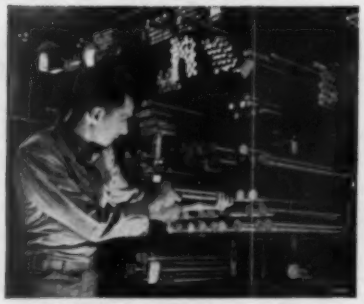
BF

BUYERS' GUIDE . . .
to Ryerson service on stainless



PLATES—Available in 9 analyses including plates to Atomic Energy Commission requirements and to ASTM specifications for code work. Also low carbon types for easy welding.

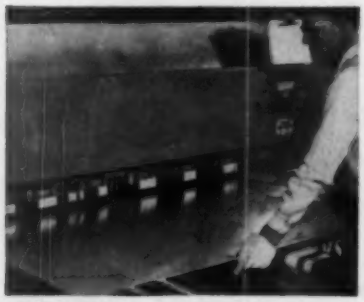
SHEETS—11 analyses of Allegheny stainless sheets in stock including nickel and straight chrome types. Also extra wide sheets to reduce welding costs, expanded and perforated sheets.



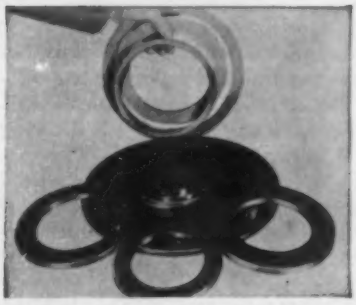
BARS AND ANGLES—Rounds, squares, flat's, hex's and angles in 8 types including free-machining bars with both analysis and mechanical properties controlled.

HELIARC CUTTING available on request. Cleaner, smoother cut edges. Better machining because of minimum contamination and distortion. Less carbide precipitation.

TRUE-SQUARE ABRASIVE CUTS. —Stainless plates to 12' x 25' cut true square on abrasive disc machine. Length and width tolerance plus or minus 1/32".



SHEARING—Accurate cutting of stainless sheets and light plate to the industry's tightest specifications. Shear hold-down clamps padded to protect sheet finish and flatness.



RINGS AND DISCS—Machine cut to your order. This service assures size accuracy, smooth edges, flatness and unaffected corrosion resistance—a lower-cost, ready-to-use product.

HEADS—A.S.M.E. flanged and dished heads in types 304, 304L, 316 and 316L are on hand in large quantities, and in a wide range of gauges and sizes.

PIPE AND TUBING—Light wall, standard and extra heavy pipe, ornamental and regular stainless tubing. Also screwed type and welding fittings and Cooper stainless valves.

RYERSON METALOGICS

JOSEPH T. RYERSON & SON, INC., MEMBER OF THE REPUBLIC STEEL FAMILY

STEEL · ALUMINUM · PLASTICS · METALWORKING MACHINERY

MATERIALS...

More oxygen for steel . . .

Sharon Steel Corp will become the seventh company in North America to make steel by a basic oxygen process. It will be the first company in the US to install Stora Kaldo furnaces. Invented by Prof Bo Kalling, Dir of Research for Stora Kopparsbergs Bergslags, AB, the Stora Kaldo process was put into operation in Sweden in May 1956.

Dravo Corp will design and build Sharon's $17.5-million plant. National Cylinder Gas Div of Chemetron Corp will build an on-site air separation plant to supply high purity oxygen for the process.

Installed at Sharon's Roemer Works, Farrell, Pennsylvania, the two-furnace operation will have an initial capacity of one million ingot tons annually. First heat is expected to be tapped in the fall of 1962.

Extend vacuum-steel use . . .

All steam-turbine rotor and spindle forgings as well as turbine powered generator shaft forgings supplied by Bethlehem Steel Co will be manufactured from vacuum steel. No increase in price is anticipated.

Bethlehem has produced all hardened steel rolls from vacuum-cast steel for several years. These rolls, originally cast from aircast ingots, were supplied without any increase in price. A pioneer in vacuum-stream degassing, Bethlehem Steel, currently is capable of producing ingots of 535,000 pounds.

Low-temperature properties . . .

Research to provide basic low-temperature performance data on 14 metals used in missile fuel valves and other critical components is underway at Battelle Memorial Institute, according to Dr Donald N Gideon.

Metals under examination are: 2800, a 9% nickel-steel alloy; Berylco 25, AT; NiSpanC; Inconel X; Berylco 25, ½ HT; 1075 steel; 6 Al-4V titanium alloy; 70-30 brass; 347 stainless steel; 17-7 PH stainless steel; 301 stainless steel XFH; A-nickel; K-Monel; and Inconel.

Sponsored by the Wright Air Development Div and the Air Force Ballistic Missile Div of the Air Research and Development Command, USAF, the research at Columbus, Ohio is in cooperation with the NBS Cryogenic Engineering Laboratories.

To determine the low-temperature fatigue properties of a metal, a 0.020 to 0.080-in.-thick specimen, measuring 1.2 by 1.6 inches, is evaluated in fully reversed plate-bending experiments at a rate of 2500 times a minute while immersed in liquid hydrogen. Each specimen material is studied at –110 F, –320 F, and –423 F, as well as at room temperature. With most materials, as was expected, both tensile strength and fatigue strength increased at cryogenic temperatures.

Ozone-damage slowed?

Physical changes caused by ozone in certain elastomers and natural rubber may soon be better understood. A new theory of the chemical actions by which some antiozonants prevent changes is being studied. According to the theory, protection is obtained by a process which crosslinks the molecules in the surface of the material, thus making it impervious to further ozone attack.

Crosslinking is believed to occur through radicals produced in a reaction between an amine anti-ozanant and peroxides created in the rubber by ozone. This mechanism should allow industrial technologists to extend the range and applications of chemical antizonants to inhibit environmental effects of ozone on materials.

Ozone in the atmosphere is one of the most significant sources of damage to many plastics and elastomers, as well as to natural rubber. More capable antiozonants would greatly broaden the application range for many of these materials.

Working stainless . . .

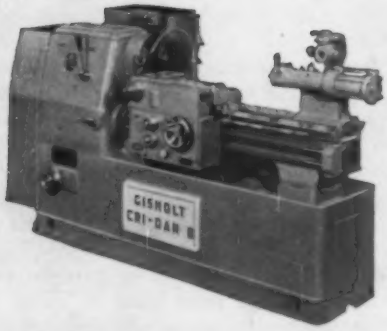
"Tricks of the trade" for high production stainless-steel machining operations are the subject of a new film produced by Armco Steel Corp. This excellent film, "Machining Stainless Steels —Part II," is the second of a series initiated in 1956.

Stressing the practical aspects of complex machining, the new film is aimed at experienced metalworking engineers and operators involved in planning, programming, and executing production machining operations. Armco's technical adviser for the machining series is George J Stevens, an authority in the field of machining stainless.

Material was collected in Armco's labs and in machine shops from coast to coast where the "off-beat" solution to a machining problem is often the only one that works. Emphasis is on solutions to actual production-line problems not usually covered in basic works on machining stainless. Questions most frequently asked of Armco's customer-service department are answered by the film.

Prints of Parts I and II can be borrowed free through The Jam Handy Organization, 2821 East Grand Blvd, Detroit 11, Michigan.

SOMEBODY *is doing it for* LESS



Gisholt CRI-DAN Model B Automatic Threading Lathe—Sets up in 8-15 minutes. Inexpensive single-point carbide tools produce all types of internal and external threads: single- or multiple-start, coarse or fine, left- or right-hand, straight or tapered, standard or special form—in any material, including new high-tensile, hard alloys.

Call your Gisholt Representative or write for Catalog 1215.

Can you afford to stay with conventional threading methods and pass up savings from 30% to 80%?

These savings can be yours with a Gisholt CRI-DAN High Speed Threading Lathe. Times are drastically reduced. You use single-point carbide tools. *Quality* threads—simple or complex—are produced automatically.

Whether you're threading in lots of 6 or 600, the CRI-DAN method will enable you to do it for less.

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MACHINE COMPANY
Madison 10, Wisconsin, U.S.A.

Turret Lathes • Automatic Lathes • Balancers • Superfinishers® • Threading Lathes • Factory-Rebuilt Machines with New-Machine Guarantee

WHAT'S AHEAD... in Metalworking

TRENDS

At last, signs of a pickup . . .

Reports from many metalworking fields indicate that a business upturn not only is here but is increasing.

The upturn is not a spectacular one by any means. Rather, it is marked by a slow but steady increase in sales. However, this increase has been widespread enough to indicate that the corner has at last been turned after months of conflicting predictions.

All signs now point to a steady upward movement throughout the year, and the year-end outlook is particularly optimistic.

For instance, that reliable barometer of metalworking activity, the steel industry, reports a slow, steady pickup in sales.

To quote one steel producer, "It's one of those things that are hard to see day to day, but by the end of the month there is a noticeable increase." Even so, things are still slow with the steel people, who have not increased production scheduling as yet, nor have they made any major recalls of laid-off workers.

Stampers are optimistic, too. Scattered reports of a pickup are coming in pretty regularly, even though not as fast as they would like.

Inquiries are on the increase, and because stampers firmly believe that today's inquiry is tomorrow's order, they are much more optimistic than they were last year at this time.

Slight month-to-month order pickups are already being registered, and the March-April increase in stampings orders is considered to be more than just a seasonal spurt.

Even foundrymen, who have long been singing the blues, say their outlook is getting more and more favorable. Most founders, for example, registered distinct gains in March over January-February levels.

The gain in castings sales, however, cannot be tied to any one customer industry—certainly not to automotive alone.

Reportedly, gray iron castings shipments increased 17% in March over February—a good bit over the normal seasonal increase.

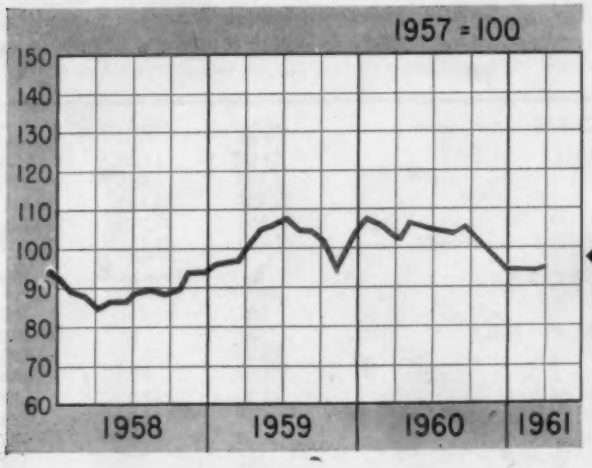
Automotive parts producers, for the first time in many months, feel encouraged by reports out of Detroit. One parts maker, for example, says he has confirmed orders that will jump his second quarter output 20-25% over first quarter.

Others report more inquiries, and believe that it will only be a few weeks or so before they can report more than the minor recalls and production increases going on now.

Makers of aircraft parts, on the other hand, report no significant change in business outlook stemming from Kennedy administration defense policy changes.

That's the overall aircraft parts picture, but within that frame there is actually a vast reshuffling of orders among individual firms (as for instance, the off-again-on-again B-70 program). On the whole, however, aircraft parts producers will hold just about to first-quarter levels in the second quarter.

On the darker side, the appliance industry is still down 10% from the same time last year. But some major manufacturers do expect a summer pickup which will last through Christmas.

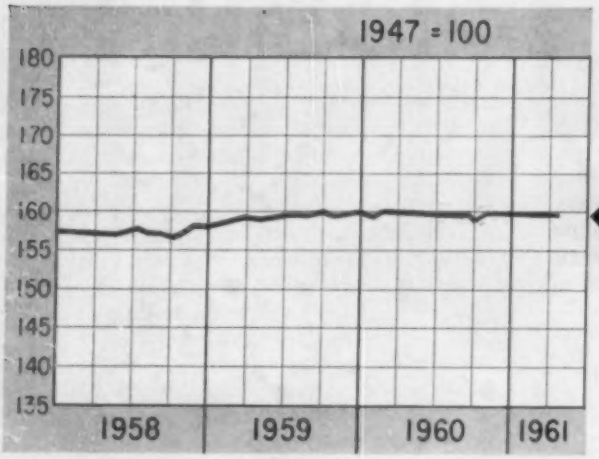


AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	APR Estimated	MAR Preliminary	FEB Revised	APR Year Ago
Total Index	**97**	**96**	**96**	**106**
Machinery	96	95	104	
Electrical Machinery	109	109	115	
Autos	86	86	118	
Other Transportation ..	88	87	87	
Other Metalworking ...	99	99	110	

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	APR Estimated	MAR Preliminary	FEB Revised	APR Year Ago
Total Index	**159.4**	**159.5**	**159.5**	**159.8**
Metalworking Machinery	**194.4**	**195.1**	**190.4**	
Other Machinery exc. Electrical	**173.8**	**173.8**	**172.6**	
Electrical Machinery	**158.7**	**158.5**	**162.2**	
Fabricated Metal Products	**147.1**	**147.1**	**148.0**	

Supporting higher spending plans . . .

The economic outlook continues to brighten. And a brightening outlook is reflected in recent business developments.

Among the most important of these is, of course, the news that businessmen have lifted their capital spending sights for 1961. As revealed by the latest McGraw-Hill survey, capital expenditures now planned for 1961 will be only 1% less than last year's plant and equipment outlays. This represents a significant increase from the spending level planned for 1961 just a few months ago. (See page 80.)

Plans for stepped up capital spending are supported by a brightening outlook for other sectors of the economy. In March, for example, the nation's personal-income level rose after a four month decline. The total gain in incomes was a substantial one, coming to $3.4 billion for the month (on an annual basis). A large part of the gain was the result of bigger transfer payments by government agencies.

But more than $1 billion came via increased wage and salary earnings, reflecting growing activity in crucial sectors of the economy.

In manufacturing, output edged slightly upward, reversing a decline that began last summer. And the number of new housing units started again showed an increase in March.

And improving incomes undoubtedly will encourage consumers to lift their spending sights, too. For, although retail sales have grown in recent months, surveys indicate that consumers don't have plans to boost their outlays for major durable goods in the immediate future. This caution in planning major durable purchases is a logical outgrowth of recent dips in earnings. It thus is likely to give way gradually to bigger durable goods outlays as business activity accelerates.

So it is clear that business' plans for another year of substantial capital outlays have a solid foundation in the improving economic outlook.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	143.0	141.8	151.6
Steel ingot operation (thousands of tons)	1,748	1,696	2,225
Electric power output (million Kilowatt hours)	14,434	14,182	13,617
Production of automobiles	114,576	93,730	135,412
Engineering construction awards (*Eng. News-Record*—thousands)	69,443	65,130	78,998

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Index of industrial production (1957=100)*	102	102	109
Index of durable manufactures production (1947-49=100)*	95	94	108
Durable goods manufacturers' sales, millions*	13.28	13.17	15.67
Machinery manufacturers' sales, millions*	4.64	4.65	4.84
Durable goods manufacturers' new orders, millions	13.36	12.88	14.80
Machinery manufacturers' new orders, millions	4.58	4.54	4.84
New Orders for Nonelectrical Machinery (1950=100)*	159	166	164
New Contracts for Industrial Construction (1950=100)*	155	163	159

*Seasonally adjusted

ACCURACY AND GRIP...

● Precisely the point...

When you buy new tools or rebuild old ones

START UP FRONT

- Precisely the point where the tool does its work.
- Precisely the point where profits are made and lost.
- Precisely the point where the accuracy and grip of Jacobs Chucks reduce tool breakage, downtime and rejects.

This is precisely the point, start up front with Jacobs.

The Albrecht Chuck is the world's finest heavy duty keyless drill chuck. It is ideal for use on high speed, sensitive drilling machines, for close tolerance work on milling machines or jig borers.

- All working parts ground and hardened
- Every piece interchangeable
- Hand locking, self tightening
- Minimum runout, exacting accuracy
- No springs . . . no key

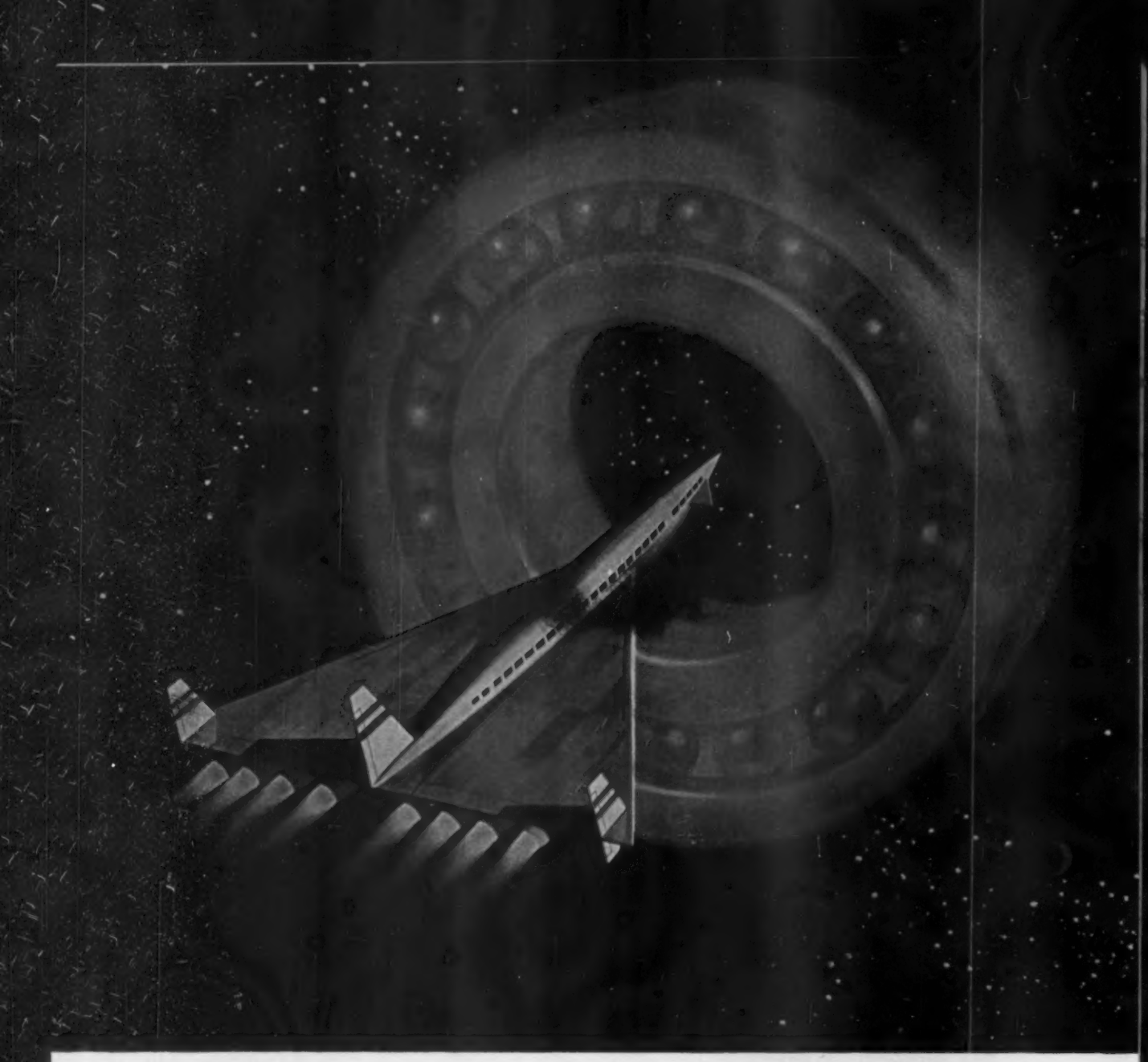
INDUSTRIAL TEAMWORK

Your industrial supply distributor knows your business. He is always ready to fill your needs quickly and economically. When you need chucks you can depend on this industrial team—Jacobs and your Jacobs industrial supply distributor.

Jacobs CHUCKS

INDUSTRIAL DISTRIBUTION · THE RIGHT HAND OF PRODUCTION

THE JACOBS MANUFACTURING COMPANY,
WEST HARTFORD, CONNECTICUT



BEARING WITH A RED HOT FUTURE

SKF MOTION ENGINEERING

Advanced ball and roller bearing technology

On special test equipment in SKF's research laboratory, experimental ball and roller bearings are run at temperatures up to 1000° F and above—conditions under which steel becomes red hot and loses its strength, while conventional lubricants burn or boil away. To meet these problems, bearings made of special heat-resisting alloys and exotic new materials are tested and evaluated. New ideas in design and new approaches to lubrication are constantly being investigated.

Bearings to resist extremely high temperatures are needed for improved, high performance jet engines, gas turbines and other equipment. Special SKF bearings have been tested successfully in environments at about 1000° F. Under certain conditions of operation, much higher temperatures are practical.

Research like this is your assurance that SKF will always keep pace with demands for the highest possible performance in all major types of rolling contact bearings —ball, cylindrical roller, spherical roller, tapered roller and precision miniature. SKF Industries Inc., Philadelphia 32, Pa. 6103

CIRCLE 209 READER SERVICE CARD

American Machinist / Metalworking Manufacturing ESTABLISHED 1877

Danger — Fierce Competition Ahead

If you think that progressive management has been sitting on its hands during recession days, how wrong can you be?

All the evidence is to the contrary. Just read corporation annual reports to get the feel of what has been going on.

Companies have been redesigning . . .

their products, developing new products, cutting costs like mad. They have been diversifying at home; and broadening their operations abroad. They have improved the quality of their products and of service to customers.

Look at Borg-Warner. It recognizes that excess capacity in durable goods industries, plus wage rate and materials price increases, has created much more competitive conditions. The result is a painful profit squeeze adversely affecting the rate of return on investment.

It has moved swiftly. It has eight construction projects going. All of them are directed toward more efficient and lower-cost operations, toward broader product lines and toward improved quality and service.

What does Borg-Warner see for tomorrow? Chairman of the Board Roy C Ingersoll says: "New products and broader application of existing ones; increasing investments in research and development and in new and modernized plants and equipment; continued profitable growth of our foreign operations."

McGraw-Hill's latest survey . . .

just published brings out the fact that hundreds of managements have been thinking in the same terms as Borg-Warner and have been acting accordingly.

American industry plans to spend more than $10 billion this year on research and development, the survey shows. This is an increase over last year. And the R&D dollar outlay will rise in the years ahead.

The result will be a flood of new products (not to mention new techniques of manufacture) which will come onto the market within two to five years after R&D is started on them. In the industrial machinery field, for example, almost one-fourth of expected sales in 1964 will be of new products. Last year it was 14%.

To reduce costs and attain the quality desired in its products, industry is stepping up its spending on new plant and equipment this year. And it is thinking in terms of investing just as much, if not more, for those purposes in 1962, 1963 and 1964.

A much higher percentage of industry's outlay for new equipment will go for modernization than ever before (70%). Thus the stress is put on lowering costs and discarding obsolete equipment and processes.

Like every other industry . . .

Metalworking has been operating far within the limits of its capacity. It will be using more of its facilities this year as the months go by. And even more next year, unless all signs are wrong. But there still will be excess capacity.

This means fierce competition for business. Many managements have foreseen this situation and have been getting ready for it. Each one is counting on acquiring more than its share of the market.

Perhaps you have been foresighted and have prepared for what's ahead. If you have not, you had better get started before it is too late. This year and next promise to be good for Metalworking, but not for everybody. Only the companies with good products coming out of low-cost, efficiently-run plants and with hard-hitting sales organizations will be able to make the most of their opportunities.

Burnham Finney EDITOR

TAKE A LONG HARD LOOK AT GRINDER PERFORMANCE...

The Model "C" Centalign® is ideal for long run, high production grinding of straight bores, tapers, and bearing raceways.

Capability, reliability and durability — not initial cost alone — are the yardsticks to use in selecting a production internal grinder.

The frequency histogram illustrated above is just one of many capability tests used to prove out *all* Bryant production internal grinders. Tests such as this one (which tabulates the quality characteristics of workpieces ground) are your assurance of predictable, day-after-day production quality when you purchase a Bryant.

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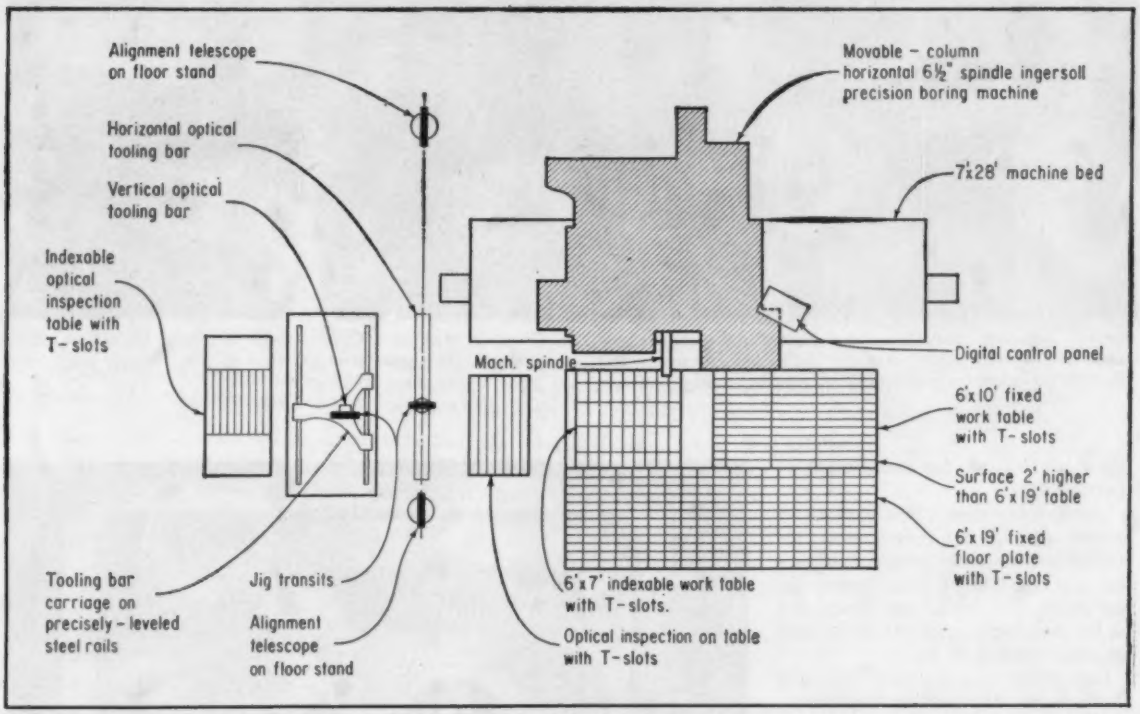
VOL 105, NO 9 **American Machinist** / *Metalworking Manufacturing* MAY 1, 1961


Alignment telescope on floor stand
Horizontal optical tooling bar
Vertical optical tooling bar
Indexable optical inspection table with T-slots
Tooling bar carriage on precisely-leveled steel rails
Jig transits
Alignment telescope on floor stand
Movable-column horizontal 6½" spindle ingersoll precision boring machine
7'x28' machine bed
Digital control panel
Mach. spindle
6'x10' fixed work table with T-slots
Surface 2' higher than 6'x19' table
6'x19' fixed floor plate with T-slots
6'x7' indexable work table with T-slots.
Optical inspection on table with T-slots

Optical tooling bars permit precise horizontal and vertical positioning of Brunson jig transits for precision inspection of workpieces on indexable worktable in front of the boring machine, or on either of two inspection tables. Installation of split worktables in front of boring machine allows some workpieces to be set up while others are machined

Split-table setup eliminates in-place inspection downtime

Optical gaging speeds boring

By Kenneth Frommer
assistant superintendent
Methods department
Ingersoll Milling Machine Co
Rockford, Ill

Far too often, inspection of precisely machined workpieces made in small lots takes more time than the machining itself. This is especially true in instances where allowable tolerances are so close that the workpiece must be inspected before it leaves the machine.

Faced with such a problem a year ago, Ingersoll came up with a three-way method of drilling and boring and inspecting holes in medium and large-sized workpieces. Essentially, it involves close integration of a highly precise machine tool with $20,000 worth of optical gaging equipment—in a setup so designed as to eliminate tying up of the machine during inspection.

Here is how it is done:

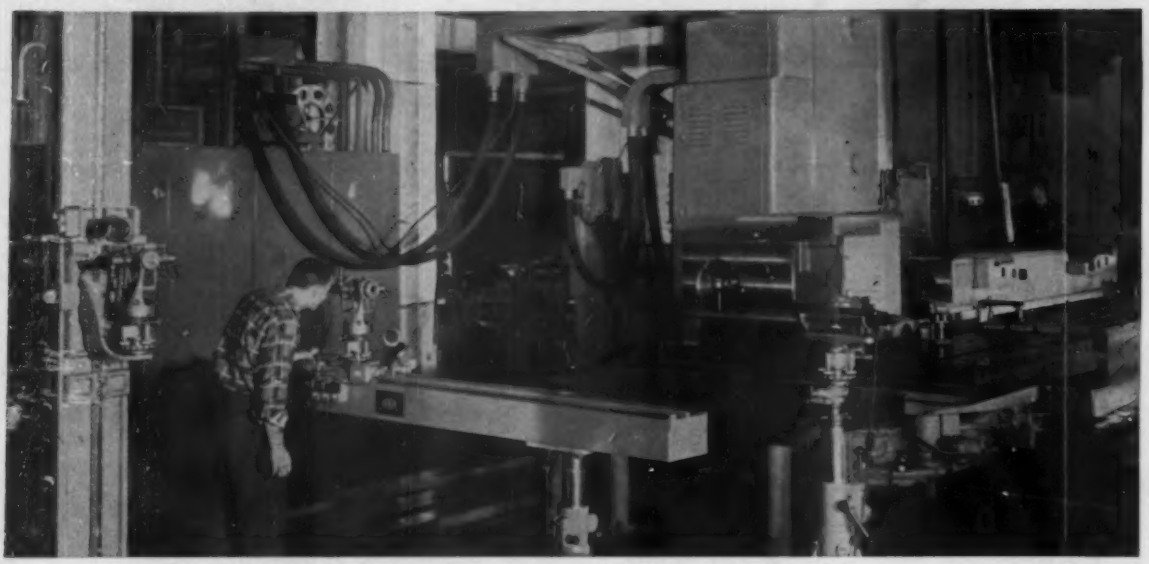
First, extreme accuracy is built into the machine itself, a 6½-inch-spindle Ingersoll horizontal boring machine designed for stub boring holes to tolerances of 0.0005 in. for location and size. The machine housing feeds in and out, eliminating bar sag; the bar is clamped hydraulically to avoid distortion, and the boring head is temperature controlled.

Split-table setup

Second, split tables allow boring to continue on one workpiece while finished work is being inspected. Work requiring close inspection is set up for inspection *and* machining on an 84 x 72-in. precision indexing table (at left of machine in above sketch).

Indexing accuracy required for this table is so great, incidentally, that it had to be shipped to the bear-

Optical gaging speeds boring . . .



Special Ingersoll movable-column, horizontal-spindle, precision drilling and boring machine (right) has Norden digital controls for accurate positioning of spindle anywhere within 78 in. x 18 ft area. Optical inspection units (shown at left in photograph) are so arranged that they can check point locations within 10 x 10 ft area

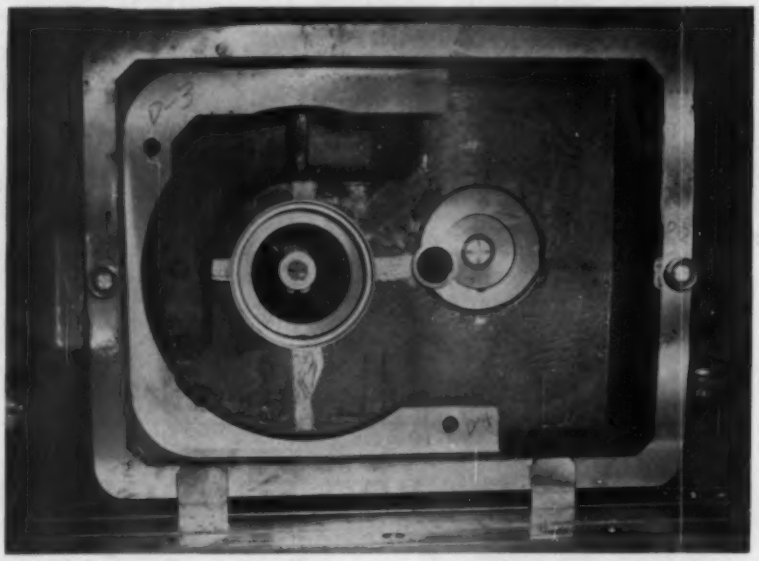
ing manufacturer for installation of the bearings.

Third, more than $20,000 worth of optical gaging equipment was installed permanently beside the boring machine. With this equipment, any point on a workpiece positioned on the indexable table can be located exactly within 0.0005 in.

Inspection time for cast iron and steel work, finished on the boring machine and checked with this equipment, has been cut as much as 60 to 70% from that required with conventional inspection methods.

Savings in inspection time are limited largely to workpieces wherein the pattern of holes to be inspected is in more than one plane. However, this involves most work scheduled to this particular machine.

For example, one workpiece with 15 precisely located holes was checked for hole location, alignment and size in 3 hours, as opposed to 11 hours by the old method.



Four displacement-type optical targets are inserted into holes precision-bored in this gear box for checking centerline locations within 0.0005 in. with jig transits on optical tooling bars. Indexing accuracy of table shown is checked optically with reflecting squares or polygons

Unique setup

Believed to be the only optical inspection setup of its kind in this country (or anywhere else for that matter), the installation consists of two 10-foot Brunson optical tooling bars—one mounted horizontally on adjustable pedestals and the other vertically on a triangular carriage which moves along precisely leveled 14-ft steel rails.

The instrument carriage on each tooling bar is equipped with a Simpson Vernac optical instrument which measures movement of the carriage to 0.0001 inch. This arrangement is easier to use and is more accurate than vernier scales.

A Model 71 Brunson optical jig transit is mounted on the carriage of the vertical tooling bar, and a Model 76 Brunson transit square on the horizontal tooling bar, which is maintained level and its transit kept square with the tooling bar ways by alignment telescopes mounted on adjustable bases and positioned at opposite ends of the horizontal bar.

Finished workpieces are inspected with optical mirrors, scales and reflecting targets, which also periodically check alignment of the boring machine and its tables.

Despite the expense involved, installation of the precision boring ma-

chine and the optical inspection justifies itself daily. Cast iron and steel housings, gear boxes, rails and other parts for Ingersoll machine tools are now drilled and bored to close tolerances in far less time than before.

Part of this gain stems from the high degree of accuracy built into the boring machine itself, and part to a Norden digital control system for numerically locating the machine's spindle—according to dimensions dialed into the system.

Near the indexable table are two fixed inspection tables for optical inspection of work machined elsewhere.

Occasionally, the alignment telescopes are removed from their pedestals at each end of the horizontal tooling bar, and mounted on adjustable instrument pedestals so as to level and align machine tools being erected on one of Ingersoll's assembly floors. When necessary, the jig transit and transit square may also be removed for similar operations. •

Setup time for locating spindle accurately at each hole to be drilled and/or bored is minimized through use of Norden digital control system (right) which has been incorporated in the electrical system of this specially-designed Ingersoll precision boring machine. Controls in this system are for all three axes of spindle nose location

Wanted: more efficient, economical machine tools

Westinghouse lays it on the line

"Moderate increases in cutting speed, the 25% improvement we have in efficiency today, just aren't good enough. My own company ended 1960 with an unspent balance of $5 million, previously authorized for the purchase of machine tools—simply because we could not find the necessary improvement in equipment."

"The machine that does the job just a little better, just a little faster is not for us," he added. "If we can't get the big improvement, we'll wait until we can."

The speaker: Mark W Cresap, Jr, president of Westinghouse Electric Corp, and host April 19-20 in Pittsburgh to the Machine Tool Electrification Forum that Westinghouse has sponsored annually for 25 years.

Following Cresap on the opening day's program, Ludlow King, executive vice president of the National Machine Tool Builders Association, sounded the keynote, "We must strive for better, more efficient, more economical machine tools."

Who, us?

It was a no-holds barred affair. Francis J Trecker, president of Kearney & Trecker Corp, also lowered the boom. "The two English-speaking nations are the most inefficient in the world."

But, he added, numerical control is ushering in the second industrial revolution "and we are faced with the possibility of a tremendous jump in productivity, possibly 50%, in a very short time—instead of the traditional 3% annual gain."

Later, W R Backer, machine research engineer, Norton Co, taking a "backward" look from the viewpoint of 1970, found that in that decade "grinding improved in efficiency through new wheels, in productivity through higher speeds, and in applicability to exotic metals through cutting-fluid chemistry—so that today (1970) it is replacing turning and boring on many jobs."

The cylindrical grinder envisioned by Backer is numerically controlled, has slides positioned on anti-friction ways, and a wheel operating on a gas-lubricated bearing spindle. Routine work tolerances: 5 microinches.

Other features would include a proximity-type, in-process gage for sizing and for sending taper-error signals to an automatic compensator. Wheel wear compensation and balancing would be continuous, and nominal speed 4000 rpm with 3-to-1 speed variation.

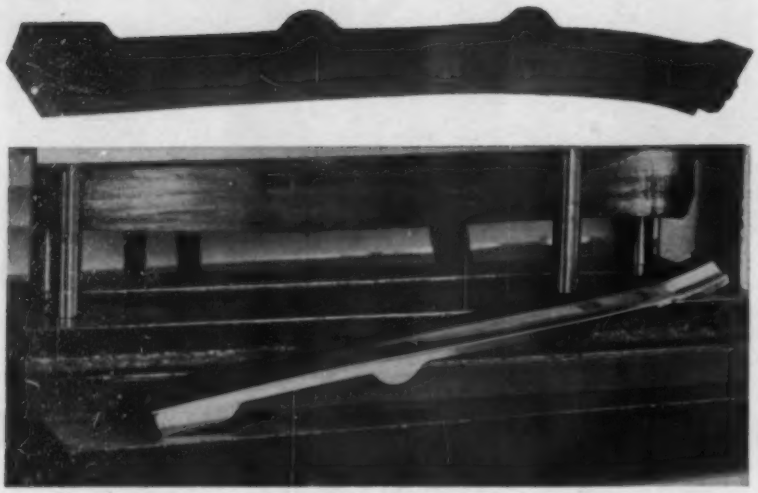
Another grinder—this one a present-day surface grinder—was discussed by W J Fant, development engineer, Gallmeyer & Livingston Co. Equipped with Incrematic feed, an electromechanical device, the grinder has automatic downfeed. The operator can dial in the total amount of stock to be removed, also the amount per pass.

Automatic grinder positioning

Speaking on cylindrical grinding, Westinghouse's N L Caban told about a special application of the Prodac control system in which the operator sets dials for the final and initial diameters of a roll. The Prodac apparatus then computes the number of passes and the infeed for each pass, and automatically positions the grinding wheel for each pass.

Prospects look good for static, adjustable-frequency power supplies, Lon Stringer and Ian MacDonald of Westinghouse told the forum. Basic circuit techniques have vastly improved, they said, and the static converter drive has the potential for solving many industrial and machine tool drive problems." •

Elastic incompressible plastic



No polishing cost—Bright-finish stainless-steel blank was scratched when formed in conventional steel dies. Cost of polishing exceeded 20 cents per piece. With a polyurethane die block and diemaker's grease applied to the blank, the part is made without any scratches. Output per "plastic" die block is 60,000 pieces

Accurate detail is produced on stainless steel parts without scratching. Although tooling is similar to rubber dies, performance puts it in a class with conventional steel dies . . . and at far less cost. Long production runs are realized

By Rupert Le Grand,
senior associate editor

Steel has a new competitor as a forming-die material. Polyurethane, a plastic, costs about as much as tool steel on a volume basis but has several attractive advantages for short or long runs:

- Virtually no machining is required, and certainly no precision work, heat-treating or grinding.
- Design effort is minimized.
- A replacement insert can be made up and tried out in short order. And the form is not lost (as when a steel die is ground).
- Production runs of 50,000-90,000 pieces are common.
- There is no scratching of the work, so that polishing of parts is eliminated. (Important to fabricators of bright-finished stainless).
- Vinyl-coated steels can be bent as much as 135° without breaking or marring the coating. Ordinarily, the limit is 60°.

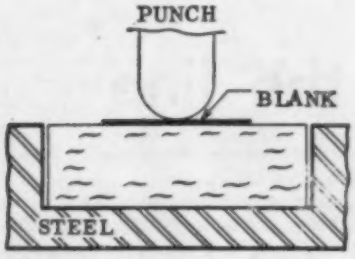


Fig. -1

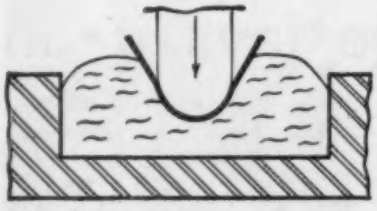


Fig. -2

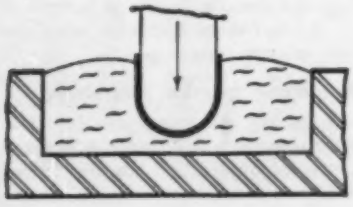


Fig. -3

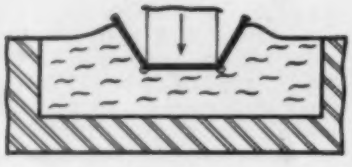


Fig. -4

Forming Action

Although high-durometer polyurethane has only about 2 to 3% compressibility, it is more fluid than die rubber. As the punch moves into the plastic, the material directly below is placed in tension. The transmitted kinetic energy displaces the plastic upward, to apply force to face of blank at an angle of 70° to 90°.

Design Rules

Size of plastic block, Fig. 1—

Width and length equal to twice the draw plus punch perimeter

Plastic depth—three times draw depth

Penetration, Fig. 3—

Not more than 70% original thickness for 0.031 gage and thicker, nor 60% for thinner material

Volume displacement above original height, Fig. 3:

For best die life—20%. If less, apply restricting frame to container

Relief—Use at bend lines, Fig. 4, to reduce pressure

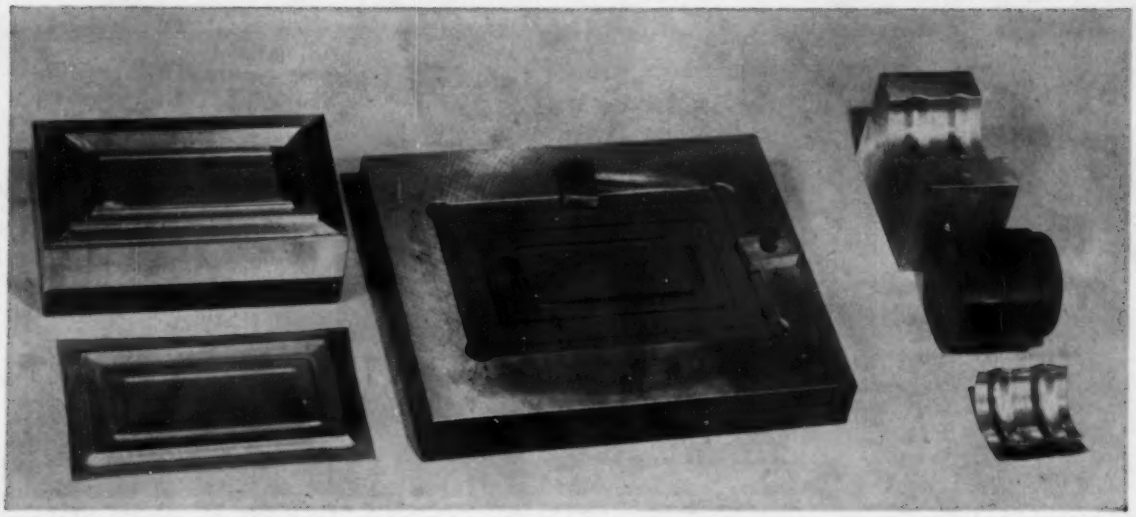
Competes with tool steel

Polyurethane is not a new plastic, but it is now formulated specifically to compete not just with die rubber but with tool steel itself. Standard Die Set Co, Providence, R I, is nationally distributing it under the tradename "ElastaCast."

To suit the many kinds of forming, bending, drawing, embossing and bulging problems encountered in industry, the plastic is available "plain" or with 6% solid lubricant and in three durometers, hardest of which is 95 durometer, elongation 550%, tensile strength, 4300 psi. (It's said that hardest die rubber is 90 durometer, and its elongation is 400%, tensile strength, 1200 psi. Therefore, the polyurethane shows less inclination to shred.)

The other two grades are 90 and 85 durometer.

makes cheaper forming dies



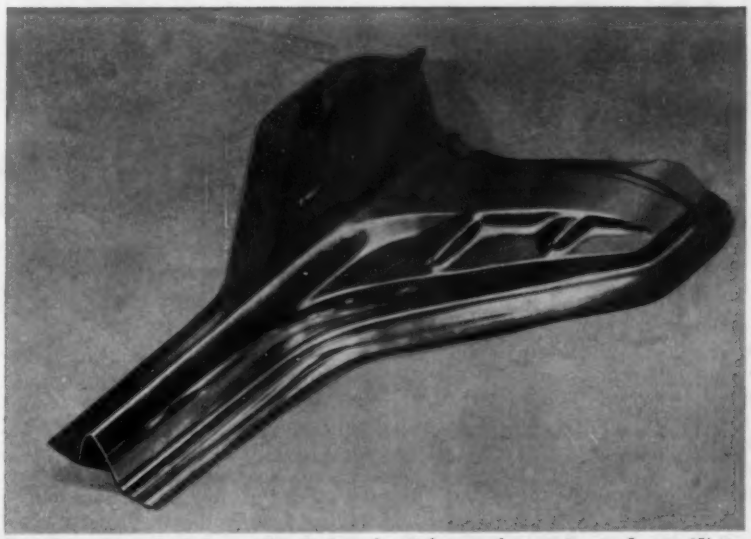
Models of successful tools—(*Left*) Steel-door manufacturer spent $8500 for steel die, which failed to produce sharp corners in panel. Capability of polyurethane to apply uniform pressure resulted in well-filled corners and a production life of 80,000 pieces per insert. Note grooves in plastic to reduce pressure. With automatic handling, press operates at 20 strokes per min. (*Right*)—Plastic is used as a punch to make a hose reel by a combination of drawing and bulging

All grades are non-absorbent with respect to die lubricants, and because of the fluidity of the plastic during the forming or drawing process, pressures are equalized through the mass. This effect has several desirable results:

- There is less likelihood of ruptures caused by local pressures
- The gage is not changed—even with a steel cup drawn to a 54% reduction.
- Bends or angles are reproduced smoothly, but not quite as sharply as the punch features.
- Forming pressures are reduced 20% or more.
- Gage variations of the stock have no effect. Therefore, die clearance is not a problem.
- Often the number of operations can be reduced.

Bulging and embossing are fields in which the plastic is likewise successful. A manufacturer of plumbing fittings is using a rod as a filler when bending. Pencil manufacturers get up to 90,000 pieces when pressing the barrel into a split die to produce fine lengthwise lines on the OD of the part.

Some of the tricks in building polyurethane dies lie in how relief is applied. A groove at a bend line, for example, reduces the pressure or displacement needed to move the plastic "around the corner." A leverage effect is created to force the blank against the punch. Sometimes these grooves are round, or a V with one vertical wall may be used. In other cases the grooves may be tapered from end to end.

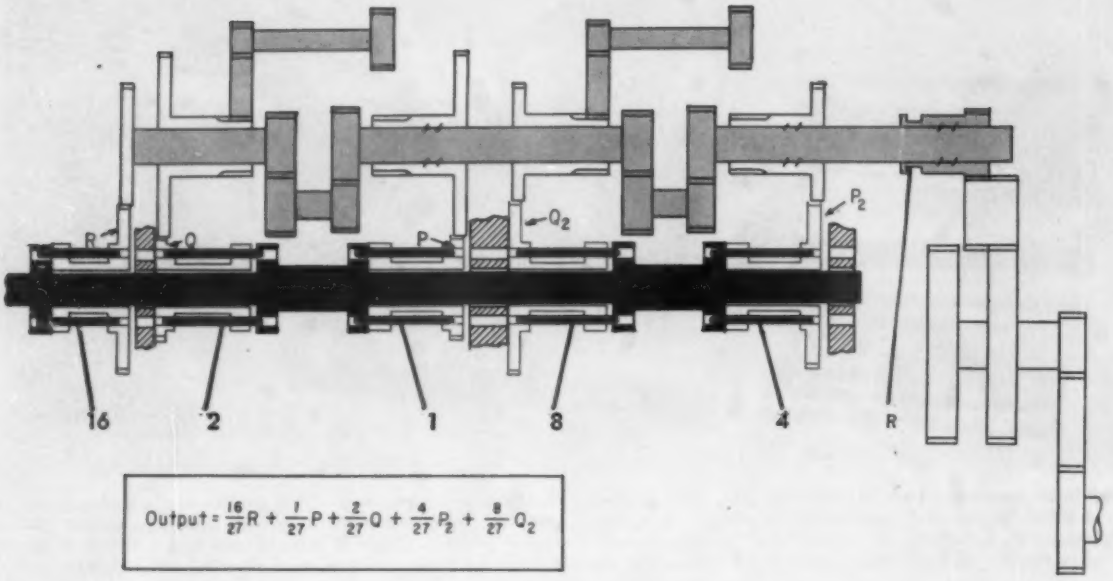


One draw instead of three—This Y-shaped stainless-steel stamping is drawn 1⅝ in. deep. Three steel dies were formerly used. Production, 15,000-plus pieces per insert

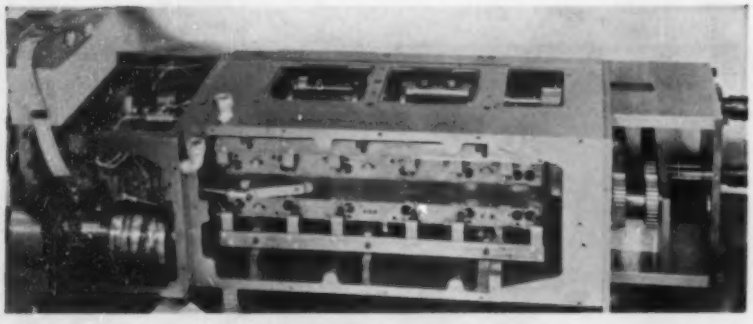
Machining of polyurethane to desired overall dimensions and "barbering" it with grooves is relatively easy. The material is cut in this manner:

- Bandsawing—½ in. wide blade, 4 hook teeth per in.; speed 200 fpm.
- Milling—Two or four-flute end mills at a feed of 150-200 fpm.
- Grinding — same as steel.
- Drilling—same speeds and feeds as for mild steel. •

Cutting tapers under mechanical



$$\text{Output} = \frac{16}{27}R + \frac{1}{27}P + \frac{2}{27}Q + \frac{4}{27}P_2 + \frac{8}{27}Q_2$$



Part of the control system (left) is a binary gear train for each axis, one of which is sketched above. Solenoids, controlled by tape, trip any combination of control pins (1,2,4,8,16,R) to set up feed increments between 0.001 and 0.031 ipr of the work, forward or reverse. Pins (red) engage gear-control clutches (red outline) that combine through differentials (shaded) to give desired output. Output equation is shown

Mechanical is the word for the controls of Barber-Colman's new N/C lathe (AM/MM—Feb 20 '61, p139). The control system differs in two fundamental ways—both involving mechanical ideas—from most of today's numerical-control systems:

- The actual control mechanism is a "black box" of gears and differentials that give direct mechanical drive for over 700 discrete tapers.
- The punched tape input, although it uses basically binary commands, actually controls length of cut with the number of sprocket holes between commands.

The control system (see diagram, right) consists of a tape reader, and an interpretive section that converts electrical input to a mechanical signal which, in turn, actuates the gear trains that control the cutting tool's motion.

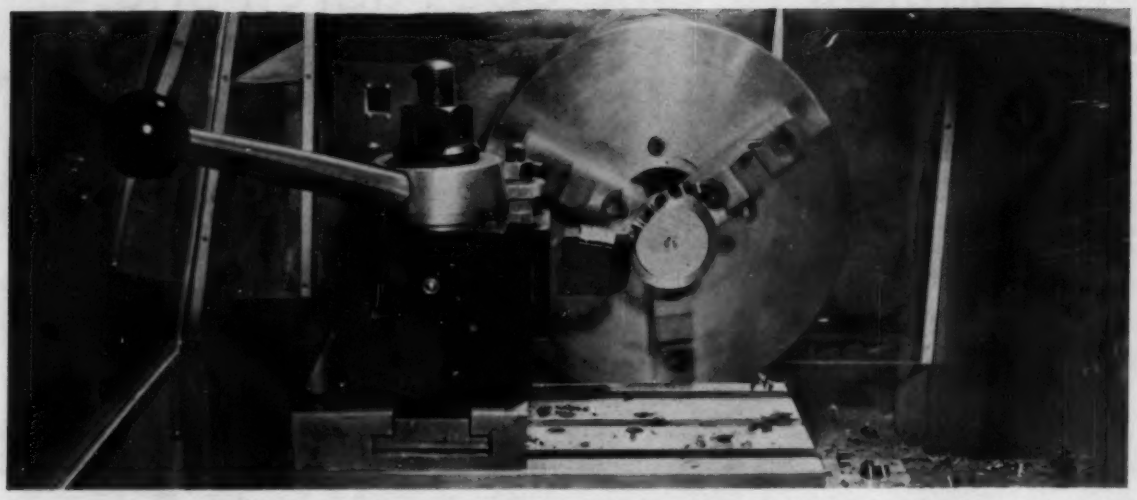
This control arrangement is divided into two axes, each of which is essentially the same; one section governs the crossfeed motion of the tool, and the other determines longitudinal feed, both of which are synchronized by the common input drive to the clutch shafts.

Binary gear trains

Each of the two differential units at the heart of the system can have five (or any combination thereof) basic inputs. These are geared in a ratio of 1, 2, 4, 8, and 16 so that, with a basic feed increment of 0.001 in., this binary input gives any combination of feeds from 0.001 to 0.031 ipr of the work. When duplications are subtracted from the more than 900 Z-X feed cominations, the result is a choice of 700 or so straight lines and tapers.

Each of these different tapers is a direct mechanical drive. The lathe does not hunt—however so slightly—about an electronically defined line; it follows the only route possible with the setup of feed and crossfeed. For this reason, the accuracy is a direct function of the system resolution—which is designed in steps of 0.001 in.

This may not seem too accurate. However, according to Chief Engineer William G Campbell, this accuracy agrees with the accuracy requirements of parts now produced on a facing and turning lathe. In addition, the company claims that the



Tapers are cut without hunting, because of direct mechanical linkage from binary gear trains controlled from the program on punched tape. Tool holder is prealigned in a tool-setter off the lathe, and can also hold boring or drilling tool

machine itself is mechanically capable of even finer work.

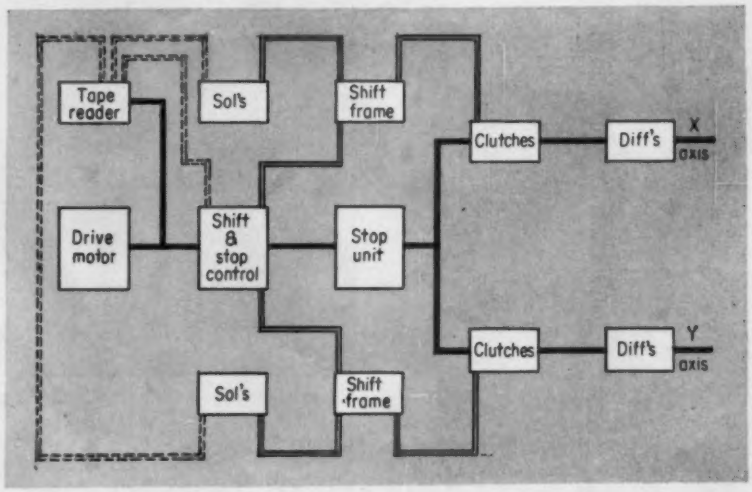
Tape for the system has a basically alpha-numeric format. There is, however, one interesting difference. After starting position, speed, and feed rate have been selected, a double-axis command is given the lathe. This consists of two consecutive commands—a longitudinal feed command followed by a crossfeed command.

Sprocket holes control

Then, the mechanical idea is brought into play. *After these feed commands have been given, the number of sprocket holes between commands sequentially counts the number of feed increments needed to define the length of the cut.* Cutting changes direction or stops only when another double-axis feed command comes to the reading head. Any new command automatically stops the previous cutting motion by disengaging clutches which disconnect differential output.

The next set of axis commands then starts a turning cut by firing solenoids that set up the proper configuration of gears required.

Another interesting portion of programming is that four different spindle speeds can be called for on a given part. The operator sets these pre-selected values into the machine console before starting the tape. During a program, the tape selects the speed desired by the programmer.



Control mechanism, pictured across page, has very few electrical circuits (only those shown by dotted lines). All other controls are linear (double line) or rotational (solid line). As can be seen, system is virtually the same for each axis

System capabilities

This system is not designed to satisfy very sophisticated, special requirements; rather, it is supposed to meet the needs of the bulk of people faced with that day-to-day problem of repetitively producing small lots of parts involving steps, tapers, chamfers, undercuts, and simple radii. And, the lathe does solve these common toolroom problems at a price that is not unrealistic.

This price is about $50,000, and it includes a tape preparation unit as well as an off-the-machine tool-setting device. Tapes from other machine tools cannot be run directly into this system, but the company has a converter that can translate other tapes. One of these could serve many machines. •

Giant press teams up with forging furnace, automatic loaders

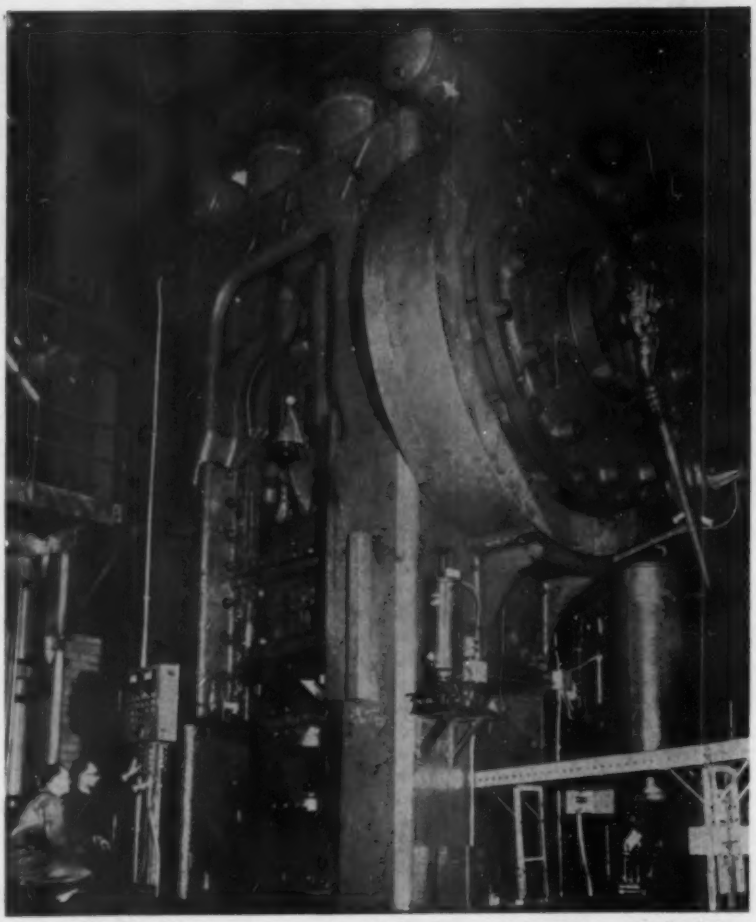
Mechanical forging goes automatic

A 6000-ton capacity mechanical forging press, a new rotary hearth furnace, a conveyor system and automatic loaders and unloaders have all combined to put mechanical forging into the "automatic" class at Eaton Manufacturing Co's Marion, Ohio, Division.

The new press, according to Eaton officials, is by far the most automated of eight of this capacity in the United States (Germany and Japan also have one each). The press was built by Cleveland's Ajax Manufacturing Co.

In the Marion setup, a Selas rotary hearth billet heating furnace receives a steel blank from a conveyor, heats it, and a conveyor carries the billet to the press.

A side loader and manipulator automatically load the heated billet into the press and transfer the semi-finished part through progressive dies, and unload the finished part onto an unload conveyor. The setup produces forgings weighing from 40 to 150 pounds.



Eaton's new 6000-ton-capacity mechanical forging press, most automated of 8 in the U S, turns out forgings weighing 40 to 150 pounds at a top rate of 35 strokes per minute, is teamed with a rotary hearth furnace, a conveyor system, and mechanical handling devices.

From 60 strokes to 3

The press can, for example, forge 110-pound ring gears in just three strokes (a job that might require 45 to 60 blows by a smaller hammer).

In the new setup, the piece moves automatically through three die cavities (buster, blocker, and finisher), but Eaton officials say the operation could be automated even more by forging one piece in each of the three die cavities simultaneously. As it is, one piece must move through all three operations before the next piece enters.

Eaton is producing two or three pieces per minute on the press, which is rated at 35 strokes per minute. Reason that Eaton hasn't gone to the ultimate in mechanization of this press (three pieces x 35 strokes a minute for a total of 105 pieces per minute) is that the company intends to use the press for a variety of forging jobs, rather than long runs of a single part, for its Axle Division and for outsiders.

The new press is effecting tremendous savings in materials. Because the press operates much faster than ordinary mechanical forging presses, the work does not have time to cool. Not only that, dies can be designed to create less scrap (less flash, thinner center plugs, for example), and Eaton has thus been able to cut 10 pounds from the billet and from the amount of scrap generated per piece. At 10¢ a pound, that's a saving of $1 per piece on materials alone.

Eaton people estimate that material savings over a wide range of forgings made on the new press average around 7%. This is especially significant because materials costs are the single biggest factor in mechanical forging—averaging 60 to 70% of the sales dollar for typical forgings.

Better die life, the Eaton people say, means holding closer tolerances. The company, for example, is holding ± 1/32 inch, whereas standard forging tolerances run anywhere from ± 1/32 inch to 3/32 inch—the latter tolerance reflecting inherent hammer die wear.

The Marion operation begins with automatic work charging of a Selas rotary hearth billet heating furnace. Heat is applied in a circular tunnel by Duradiant burners which heat the work as it rests in the rotary hearth.

The rotary hearth of the furnace,

which can heat 6- and 7-in. round-cornered square steel billets 5½ to 12⅝-in. long, is automatically indexed in sequence with the handling operation through three controlled temperature zones.

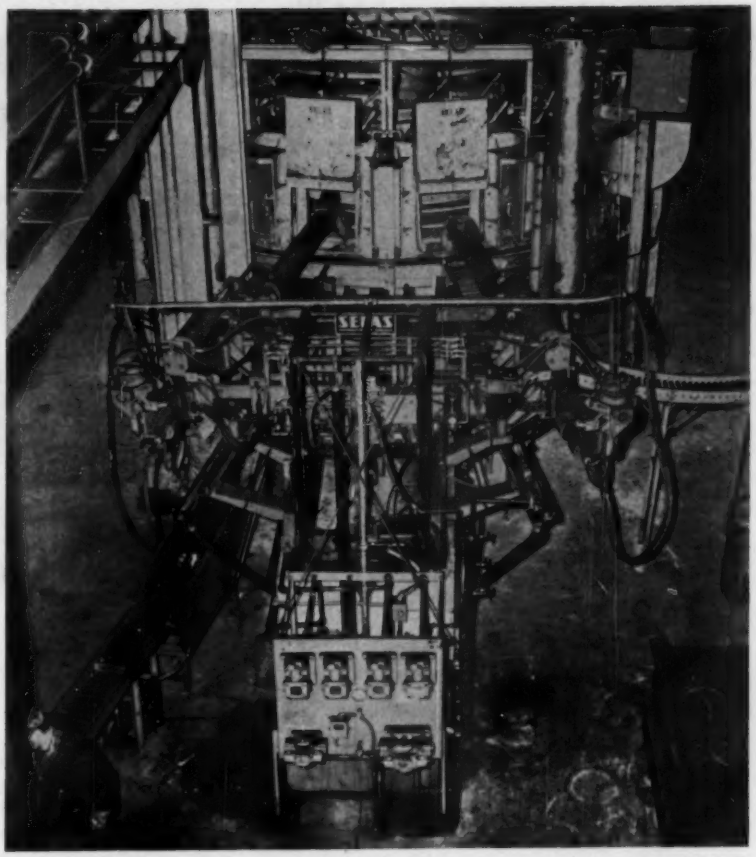
An unloading clamp picks up the hot work, releases it to a discharge conveyor automatically. The press's side loader picks the hot billet off the conveyor and loads it into the press, where a manipulator transfers the work through the three die impressions, and onto a conveyor.

Mechanical loading

The mechanical load and unload mechanisms for the press were designed and built by Eaton's Technical Center, will handle a variety of forgings. The only requirement such forgings must have in common are 2-inch-diameter, 2-inch-high studs for the mechanism to grasp.

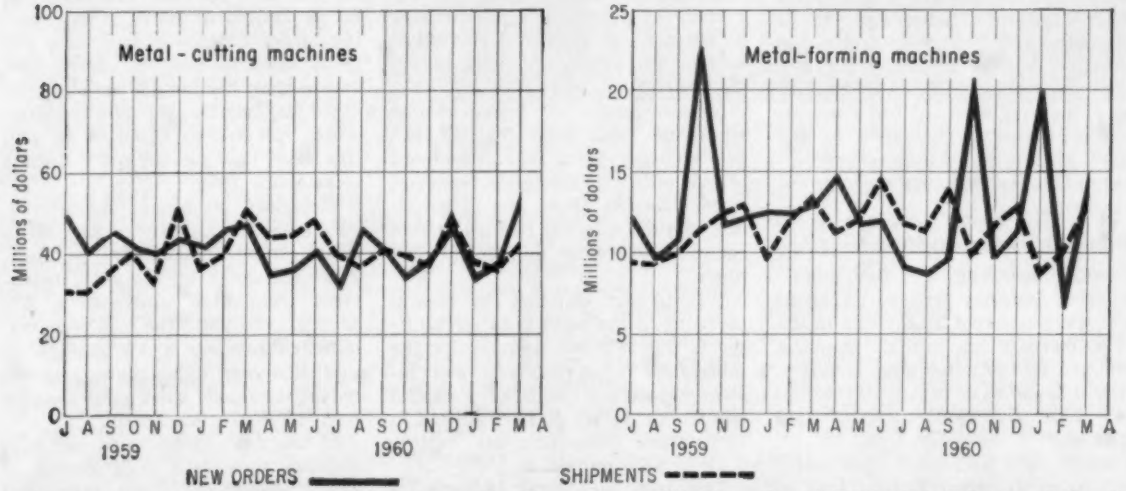
The entire installation requires only four men: one to feed cold billets into the furnace, one to operate the forging press, one to operate the trimming press, and a "release" man.

With the new setup, Eaton (aside from doing work for its own divisions) will go after forging business in the auto and truck fields: crankshafts, axle shafts, ring gears, brake spiders, and ultimately steering knuckles for heavy trucks, aircraft landing gear frames—or anything that will fit into the 48 x 72-inch press bed. •



Rotary hearth furnace receives steel blank from a conveyor, heats it to 2200 F, feeds directly to three-stage die on 6000-ton-capacity press. Made by Selas, the furnace takes billets up to 12⅝ in. long of 8620 and 4718 steel

NMTBA Index of machine tool new orders and shipments



Net new orders for metal-cutting machine tools rose sharply in March to a total of $54,650,000, according to preliminary figures from the National Machine Tool Builders' Association. February orders were $39,450,000. Shipments in March rose to $41,050,000, up from $35,600,000 in February. Orders for metalforming machine tools rose to $14,900,000 in March, up sharply from $6,950,000 in February. Shipments rose to $13,050,000 in March, up from $10,050,000 in February

Metalworking to invest $4 billion

Capital spending: Steady in 1961

American business now plans to spend $35.35 billion for new plants and equipment in 1961, only 1% less than in 1960. And advance plans for the years 1962-1964 are almost as high as expenditures planned for this year.

• Manufacturing industries, as a whole, will spend $14.09 billion, 3% less than the $14.48 billion they spent in 1960.

• The metalworking industry will spend $4.00 billion, only 1% less than its 1960 capital outlay of $4.04 billion.

American business has raised its sights since last fall, a fact made clear in the McGraw-Hill Economics Department's annual survey of capital spending plans. The preliminary checkup on 1961 spending plans made last fall revealed that business would spend 3% less in 1961 than in 1960.

Not all industries have revised their plans upward. But in those industries where capital investment is highest—machinery, autos, chemicals, petroleum, electric and gas utilities, communications, and transportation (other than rail)—plans have moved upward.

Capital spending plans of manufacturing companies (billions of dollars)

	1960	1961	1960-61	Preliminary plans		
	Actual	Planned	% Change	1962	1963	1964
Machinery	$1.10	$1.14	+ 4	$1.09	$1.11	$1.13
Electrical machinery	0.68	0.73	+ 8	0.66	0.62	0.62
Autos trucks & parts	0.89	1.01	+14	1.00	1.16	1.03
Transportation equip. (aircraft, ships, R.R.)	0.42	0.40	— 5	0.33	0.30	0.28
Fabricated metals & Instrts.	0.95	0.72	—24	0.75	0.81	0.79
ALL METALWORKING	4.04	4.00	— 1	3.83	4.00	3.85
Iron and steel	1.60	1.18	—26	1.33	1.04	1.12
Nonferrous metals	0.31	0.31	0	0.35	0.41	0.46
Chemicals	1.60	1.66	+ 4	1.58	1.60	1.74
Paper and pulp	0.75	0.68	— 9	0.60	0.61	0.62
Rubber	0.23	0.22	— 6	0.23	0.24	0.24
Stone, clay, glass	0.62	0.59	— 5	0.55	0.55	0.53
Petroleum & coal products	2.64	2.85	+ 8	2.88	2.82	2.88
Food and beverages	0.92	0.99	+ 8	0.97	0.85	0.85
Textiles	0.53	0.39	—26	0.37	0.36	0.36
Miscellaneous mfg.	1.24	1.22	— 2	1.23	1.12	1.06
ALL MANUFACTURING	14.48	14.09	— 3	13.92	13.60	13.71

Outlook is good

The high level of investment now planned by business indicates strength in the business outlook for 1961 and the years ahead. Plans can, and frequently do, change to conform with future developments in overall business conditions. But the fact that plans beyond 1961 are now at a very high level would indicate that actual spending may turn out to be considerably higher. Considered in the light of past performance, preliminary plans for 1962-1964 are very encouraging.

Pickup in auto industry

Though spending by the metalworking industry will be off about 1%, there is a real bright sign in the 14% increase in capital spending planned by the automotive industry. It will spend $1.01 billion in 1961, up 14% from the 1960 outlay of $890 million.

Electrical machinery producers now plan to invest $730 million in 1961, a jump of 8% from last year's $680 million. An interesting note here is that the electrical machinery industry is planning to put 44% of its 1961 outlay into expansion. (The rest goes for replacement and modernization.) This is the highest percentage for expansion in the metalworking industry.

Builders of non-electrical machinery, who last fall planned to reduce their capital outlay in 1961, have reversed their position and now plan to boost their investment to $1.14 billion, 4% above the $1.10 billion they spent last year.

Manufacturers of transportation equipment will trim 5% off last year's outlay, for a 1961 investment of $400 million. This figure, however, is considerably above the $370 million that the industry had planned to spend in 1961 when queried last October.

The largest decrease in capital spending in the metalworking industry is the 24% cut planned by the fabricated metal products and instrument industries. After a capital equipment outlay of $950 million in 1960, these companies are cutting back to $720 million in 1961.

The iron and steel industry is slashing its capital spending by 26% in 1961. It put $1.60 billion into new plant and equipment in 1960, but plans to spend only $1.18 billion this year. Replacement and modernization will claim 85% of this total, with 15% going into expansion.

Manufacturing sales outlook

Manufacturing companies expect unit sales to rise 3% this year and another 20% by 1964. The transportation equipment industry, anticipating larger defense orders, now expects sales to rise 7% above 1960 rather than decline 4% as was indicated last fall. But the auto industry, which last fall expected to do well this year, now forsees a 7% decline in sales for 1961.

Electrical machinery manufacturers expect sales to rise 3%, as do nonelectrical machinery builders. The fabricated metals and instrument companies anticipate a 5% sales gain in 1961. The iron and steel industry foresees a 1% decline in sales this year. Other manufacturing industries expect sales gains ranging from 1% to 7% next year.

In the next three years the auto industry foresees a sales growth of 28%; machinery, 24%; fabricated metals and instruments, 22%; electrical machinery, 20%; transportation equipment, 7%. •

Screw-machine line produces bearing races from steel tubing. Plant layout groups each type of machine in the bearing-manufacturing process, providing automatic chip-removal, coolant-supply, and other services for each group

Flexible layout boosts production

What sort of plant would you build for a highly diversified operation, if you could start from scratch?

Production men at the Fafnir Bearing Co had this once-in-a-lifetime opportunity some five years ago, when the New Britain, Conn firm decided to build a new plant in nearby Newington.

The result: Today Fafnir has completed—just in time for its 50th-anniversary celebration—a 460,000-sq-ft plant that can turn out 50,000 bearings a day.

"Custom-made" from the ground up, the new facility is built for flexibility. In the future, Fafnir can expand the plant easily.

There is another advantage in this planned flexibility. The plant is set up for short-run manufacture of as many as 11,000 different types of bearings a year. The new setup can accommodate a maximum number of orders in a minimum of time.

Clean room excludes dirt and dust from miniature bearing assemblies. Temperature- and humidity-controlled, room is supplied with air that passes through five filters

Key layout features

Here are key layout features:

- Each operation in the bearing-making process is set up for continuous flow of work and materials.
- Machines are grouped by types—screw machines in one area, grinders in another, and so forth. Each group is automated as much as possible. A continuous-conveyor system carries chips away from screw machines. Underground piping carries coolant to and from each grinder.
- Layout is modular, with uniform machine spaces and aisles integrated with overhead supply and underground removal systems.
- Two-story mezzanines, flanking the manufacturing area, house tool cribs, power sources, boilers, rest rooms, and the like.
- The ventilation system—important in bearing manufacture—is monitored and controlled centrally.
- A standby water system for fire, and a circulating water system for heat treating, are completely independent of the municipal system.

Super-clean room

The company also has completed installation of a "clean room" (see photo) at its main plant in New Britain. Built as an assembly area for miniature bearings, the super-clean room is divided into several areas that separate each of the final stages of bearing production. Air in each area is passed through five filters that exclude dust particles of more than 0.000008-in. size. ●

HEAT TREATED DIAMONDS?

Yes, and according to new tests made by Engelhard Hanovia, they're better in some grinding applications than manufactured diamonds or un-heat-treated natural diamonds

By Anderson Ashburn,
managing editor

Fresh fuel has been added to the growing controversy over the different type of diamonds available for grinding, by a series of tests conducted by Carl W Highberg. The tests were made at the Newark, N J, laboratories of Engelhard Hanovia, U S distributor of natural diamonds.

The Highberg tests compare natural diamonds, selected natural diamonds in untreated and treated condition, and manufactured diamonds —all in resinoid bonds for carbide grinding.

Test results released

Copies of the test results have been circulating among diamond wheel manufacturers and have caused some lively discussion. The basic data obtained in these tests is published in Tables I through VI. Some of these results compare with previous studies, some differ widely.

Most recent tests have shown greater wheel efficiency for manufactured diamonds than for natural diamonds. The Highberg tests generally agree with that, but show higher efficiency for treated diamonds in some cases than for either.

In other cases, manufactured diamonds are more effective. In a few instances the untreated selected diamonds come out best, and in a few cases natural diamonds seem best.

There is evidence, Highberg feels, that conventional conditions for grinding carbide with diamond wheels may not be the most efficient conditions. He feels that additional tests are needed to determine the most effective surface speed, table speed, wheel feed, and wheel size for carbide grinding.

Test results showing medium grits to be more efficient than coarse grits are particularly surprising, and additional tests to see if these results are confirmed may be expected.

Table I: Medium grit cup wheels of various designs

Wheel	Total downfeed (In.)	Total wheel wear (In.)	Average Carbide wear (In.)	Efficiency ratio	Spindle power cut (watts)	Q*	Average surface finish (Mu.-in.)
4 x 1¼ x 1/16-in. wheels at 3800 sfpm							
D150	0.050	0.0169	0.0484	11.0	572	19	10.5
SNDMU	0.048	0.0113	0.0479	16.5	740	22	17.3
SNDMT	0.048	0.0313	0.0453	5.6	712	8	17.6
RVG150	0.048	0.0221	0.0466	8.3	642	13	15.3
4 x 1¼ x ⅛-in. wheels at 3800 sfpm							
D150	0.120	0.0129	0.1188	22.9	732	31	8.0
SNDMU	0.120	0.0093	0.1184	25.2	600	42	8.0
SNDMT	0.151	0.0053	0.1494	59.5	648	92	10.1
RVG150	0.120	0 0109	0.1184	21.9	755	29	10.6
5x 1¼ x ⅛-in. wheels at 4700 sfpm							
D150	0.096	0.0226	0.0959	6.6	1477	4	9.9
SNDMU	0.096	0.0116	0.0946	12.8	950	13	16.8
SNDMT	0.096	0.0086	0.0962	17.6	1045	17	13.1
RVG150	0.120	0.0175	0.1199	10.7	1307	8	10.2

* $Q = \frac{\text{Efficiency ratio}}{\text{Spindle power}} \times 1000$

CONDITIONS: Dry grinding with D11V9-type wheels of 44A carbide, ½ x ¾ in., at 3600 rpm spindle speed, table feed of 36 ipm, consecutive downfeeds of 0.0015 in. (except 0.0010 in. on D150 wheel in first series) to give total downfeed shown on table.
WHEELS: D150 is 150-grit natural diamond; SNDMU is selected natural diamond, untreated, 120 to 200 grit; SNDMT is selected natural diamond, treated, 120 to 200 grit; RVG150 is resinoid-bond grade manufactured diamonds, 150 grit. Shape count of SND wheels not reported.

Table II: Comparison of medium and coarse grits

Wheel	Total downfeed (In.)	Total wheel wear (In.)	Average Carbide wear (In.)	Efficiency ratio	Spindle power cut (watts)	Q	Average surface finish (Mu.-in.)
Medium, grits, 72 imp table speed, 0.001 downfeed							
D150	0.090	0.0161	0.0898	10.9	1050	10	9.9
SNDMU	0.100	0.0107	0.1016	18.6	850	22	10.5
SNDMT	0.100	0.0061	0.1011	32.9	940	35	11.4
RVG150	0.100	0.0083	0.1033	24.0	1014	24	10.7
Coarse grits, 72 imp table speed, 0.001 downfeed							
D100	0.062	0.0228	0.0596	5.5	862	6	11.8
SNDCU	0.100	0.0186	0.0934	10.0	717	14	12.6
SNDCT	0.075	0.0146	0.0745	9.8	852	12	12.1
RVG100	0.100	0.0103	0.1001	19.0	727	26	15.6
Medium grits, 36 ipm table speed, 0.0015 downfeed							
D150	0.120	0.0129	0.1188	22.9	732	31	8.0
SNDMU	0.120	0.0093	0.1184	25.2	600	42	8.0
SNDMT	0.153	0.0053	0.1494	59.5	648	92	10.7
RVG150	0.120	0.0109	0.1183	21.9	755	29	10.6
Coarse grits, 36 imp table speed, 0.0015 downfeed							
D100	0.094	0.0269	0.0930	6.7	1120	6	11.0
SNDCU	0.090	0.0102	0.0892	17.2	1080	16	8.8
SNDCT	0.090	0.0122	0.0906	14.6	1097	13	12.0
RVG100	0.090	0.0072	0.0905	25.4	965	26	10.3

CONDITIONS: Dry grinding with D11V9-type wheels of 44A carbide, ½ x ¾ in., at 3600 rpm spindle speed. Wheels 4 x 1¼ x ⅛ in.
WHEELS: Medium grit wheels as in Table I. Coarse grit diamond (D) and manufactured (RVG) were 100 grit. Selected natural diamond wheels untreated and treated, were 80 to 120 grit. Shape count of SND wheels not reported.

In this series of tests (Table II), the selected treated diamonds show higher efficiency in the medium grits and the manufactured diamonds show higher efficiency in the coarse grits. However, each grade of diamonds has a higher efficiency ratio in the medium grit than the same grade has in the coarse grit tested.

In a similar comparison of wheel designs, a 4-in. OD ⅛-in. rim flaring cup outperformed a 5-in. OD ⅛-in. rim and a 4-in. OD 1/16-in. rim. These tests (Table I) were operated at a volumetric feed rate for each type of wheel of 0.027 cu. in. per min. Whether these relationships will hold true for conditions producing other volumetric feed rates is a question that must await additional tests.

Testing cup wheels

In the test of cup wheels, in which eight pieces of carbide were indexed per downfeed (Table III), the eight pieces were horizontally mounted on an indexing head. One piece of carbide was ground per complete table reversal, then the next piece was indexed into position. After all eight had been ground, the next downfeed was made.

The tests in Table III can also be compared with the first set in Table II, which involve the same cutting conditions except that in one case there are eight pieces of carbide—in the other is a single piece. Higher efficiency is obtained when grinding a single piece.

Peripheral grinding

On peripheral grinding with 5-in. wheels (Table IV) there is more difference in the efficiency ratios of different types of diamond at 0.001 in. downfeed than there is at higher downfeeds.

At the 0.001-in. downfeed, the natural diamond produces the highest ratio at the lower table speed tested, the manufactured diamond produces the highest ratio at the higher table speed. At higher downfeeds (0.002 and 0.003 in.) differences between the types of diamond almost disappear and certainly become too small to be significant.

In peripheral grinding with coarse grits (Table V), the best efficiency ratios are found with the selected treated diamonds. A strange feature of this data is that the coarse treated diamonds outperform the medium grits of the same type (Table IV), while the other three types generally seem to do better in the medium grits. The latter condition was true of all four types in the flaring cup wheel tests.

Table III: Indexing eight pieces of carbide per downfeed

Wheel	Total downfeed (In.)	Total wheel wear (In.)	Average Carbide wear (In.)	Efficiency ratio	Spindle cut power (watts)	Q	Average surface finish (Mu.-in.)
D150	0.100	0.0125	0.0907	14.3	1020	14	12.0
SNDMU	0.100	0.0100	0.0939	18.6	860	22	11.0
SNDMT	0.100	0.0100	0.0934	18.6	820	23	11.5
SD150	0.100	0.0098	0.0946	19.1	880	22	11.8

CONDITIONS: Dry grinding with D11V9-type wheels of eight pieces of 44A carbide mounted at 45° intervals on a 10-in. indexing head to simulate milling cutter grinding. Spindle speed 3600 rpm, table spaced 72 ipm, individual downfeed of 0.001 in. after grinding all eight pieces. Only one piece of carbide surfaced per complete table reversal.
WHEELS: Same as in Table I, 4 x 1¼ x ⅛ in.

Table IV: Peripheral Grinding with Medium Grits

Wheel	Total downfeed (In.)	Total wheel wear (In.)	Average Carbide (In.)	Efficiency ratio	Spindle power (watts)	Q	Average surface finish (Micro-inches) with lay	Average surface finish (Micro-inches) across lay
Table speed 45 fpm; crossfeed 0.035 in., downfeed 0.001 in.								
D150	0.115	0.0074	0.1048	96.4	540	178	11.2	23.6
SNDMU	0.130	0.0090	0.1215	87.7	520	169	14.4	38.5
SNDMT	0.130	0.0108	0.1167	69.6	440	159	8.7	34.1
RVG150	0.125	0.0081	0.1160	91.9	600	153	16.7	50.6
Table speed 45 fpm; crossfeed 0.035 in., downfeed 0.002 in.								
D150	0.066	0.0132	0.0543	27.4	800	34	15.4	46.9
SNDMU	0.060	0.0119	0.0497	26.9	720	37	13.7	46.9
SNDMT	0.060	0.0127	0.0488	24.7	600	41	13.7	45.9
RVG150	0.060	0.0119	0.0485	26.-	680	39	17.4	53.4
Table speed 45 fpm; crossfeed 0.035 in., downfeed 0.003 in.								
D150	0.036	0.0107	0.0240	14.8	1040	14	13.4	48.4
SNDMU	0.036	0.0130	0.0238	11.9	880	14	16.3	70.0
SNDMT	0.036	0.0112	0.0242	14.3	880	16	18.0	74.7
RVG150	0.036	0.0116	0.0246	13.7	840	16	18.3	60.0
Table speed 55 fpm; crossfeed 0.035 in.; downfeed 0.001 in.								
D150	0.100	0.0126	0.0864	45.4	520	87	11.1	35.6
SNDMU	0.100	0.0118	0.0864	48.3	460	105	12.6	35.3
SNDMT	0.090	0.0095	0.0797	52.7	560	94	14.4	45.8
RVG150	0.080	0.0071	0.0732	67.5	500	135	14.0	38.2
Table speed 45 fpm; crossfeed 0.050 in.; downfeed 0.002 in.								
D150	0.048	0.0156	0.0330	13.2	760	17	16.9	100.0
SNDMU	0.048	0.0147	0.0347	14.6	680	22	16.3	99.7
SNDMT	0.048	0.0136	0.0346	15.4	740	21	21.5	29.8
RVG150	0.048	0.0145	0.0344	14.6	760	19	17.8	68.1

CONDITIONS: Wet grinding of 44A carbide, 3x6 in., with 5x3/16x1¼-in. D1A1 wheels. Spindle speed 3600 rpm producing 4710 sfpm. Abrasive M3 grinder.
WHEELS: Diamond grades and grits in the wheels same as in Table I.

Test conditions

Test wheels were produced by a wheel manufacturer using coarse and medium selected diamond grits in both treated and untreated condition, natural diamonds in 100 and 150 grit sizes, and manufactured diamonds in 100 and 150 grit sizes. (SND grades are not available in grit sizes.)

Two tests were run for each set of test conditions and if the results *did not* differ by more than 30%, the two results were averaged to form a single test result in the tables. If the results *did* differ by more than 30%, an additional test was run and the three tests averaged.

Cup wheel tests were run on an Abrasive M34 vertical-spindle grinder with automatic downfeed. The test amount of downfeed was made at every other table reversal, with the total downfeed per test being enough

to yield about 0.005 in. wheel wear.

Peripheral wheel tests were run on a Thompson 6x18-in. surface grinder, and an Abrasive M3 8x24-in. mechanical surface grinder.

Study of treated grit

It was originally thought that the principal effect of treating natural diamond grit was to increase the friability. That is, the diamond particles would break during use to expose fresh cutting edges. This would result in fewer diamonds being torn from the bond, according to this theory.

Dr Michael Seal at the Englehard Hanovia laboratories has been studying treated grit under optical and electron microscopes at magnifications up to 100,000X and has concluded that there is no factual support for this theory.

The only difference Dr Seal has been able to find between treated and untreated grit is in the layer of graphitic carbon formed during the heat treatment. This graphite coating can be removed by hard abrasives such as alumina, but not by ordinary rubbing. It is his theory that the coating improves the adhesion between the resin bond and the diamond.

Graphite bond

Graphite is considerably more chemically reactive than diamond and more easily wet. It would thus stand a much greater chance of forming a positive bond to an organic resin than would diamond, according to Dr Seal.

Diamonds heated in air start to burn at about 700 C. If they are heated in a vacuum or a non-oxidizing atmosphere, diamonds are stable at much higher temperatures, but will change to graphitic carbon. This change begins at about 1000 C. Up to about 1650 C, the graphite forms as an adherent surface layer. At 1400 C, the layer is about 1 micro-in. thick, at 1650 C, it is about 20 micro-in. Beneath this film the diamonds are apparently unchanged.

Dr Field reports that the appearance of used diamond wheels lends support to his hypothesis. Wheels that are equivalent in all respects except heat-treatment were compared. Bond, concentration of diamonds, grit size, shape count, wear tests in dry grinding of tungsten carbide were the same, but one wheel had treated diamonds and the other had untreated.

Wear characteristics were the same in both wheels with extensive wear flats formed on protruding diamond particles. However, more diamonds remained in the bond with the treated diamonds, he says.

The exact conditions of the heat-treating process given to diamonds have not been reported, but it is believed to consist of heating the diamonds under conditions that will not permit oxidation (probably an atmosphere furnace) to a temperature that is probably above 1400 C and quenching them. •

Table V: Peripheral grinding with coarse grits

Wheel	Total downfeed (In.)	Total wheel wear (In.)	Average Carbide wear (In.)	Efficiency ratio	Spindle power cut (watts)	Q	Surface finish with lay	Surface finish across lay
0.001 downfeed								
D100	0.100	0.0146	0.0845	38.2	520	74	19.0	85.5
SNDCU	0.100	0.0128	0.0888	48.3	526	92	15.5	43.7
SNDCT	0.120	0.0066	0.1150	110.0	680	162	15.6	41.2
RVG150	0.100	0.0113	0.0931	49.2	560	88	17.7	46.0
0.002 downfeed								
D100	0.040	0.0124	0.0291	16.1	935	17	16.8	52.5
SNDCU	0.039	0.0150	0.0268	11.3	726	16	16.1	31.3
SNDCT	0.040	0.0104	0.0300	18.5	717	26	13.6	49.3
RVG100	0.056	0.0202	0.0353	12.4	560	22	18.0	45.4

CONDITIONS: Wet grinding of 44A carbide, 3x6 in., with 5x3/16x1¼-in. D1A1 wheels. Table speed 53 fpm, spindle speed 3600 rpm producing 4710 sfpm, crossfeed 0.042 in. Thompson grinder.
WHEELS: Diamond grades and grits in wheels same as Table II.

Table VI: Peripheral Grinding at 4200 rpm

Wheel	Total downfeed (In.)	Total wheel wear (In.)	Average Carbide wear (In.)	Efficiency ratio	Spindle power cut (watts)	Q	Average surface finish (Microinches) with lay	Average surface finish (Microinches) across lay
0.035 crossfeed; 0.001 downfeed								
D150	0.130	0.0102	0.1176	81.5	640	127	11.6	26.3
SNDMU	0.110	0.0121	0.1017	51.8	490	108	16.7	44.7
SNDMT	0.130	0.0078	0.1207	102.0	660	155	9.5	25.2
RVG150	0.150	0.0084	0.1404	116.0	680	170	15.4	51.8
0.035 crossfeed; 0.002 downfeed								
D150	0.050	0.0123	0.0394	19.9	860	23	12.8	41.6
SNDMU	0.060	0.0096	0.0503	32.8	800	41	14.0	42.2
SNDMT	0.050	0.0054	0.0438	51.4	880	58	10.8	27.4
RVG150	0.050	0.0073	0.0425	38.0	820	46	15.2	30.1
0.050 crossfeed; 0.002 downfeed								
D150	0.048	0.0145	0.0332	14.1	720	20	14.1	70.3
SNDMU	0.048	0.0128	0.0343	16.6	760	22	21.2	101.9
SNDMT	0.048	0.0134	0.0367	16.8	800	21	13.9	71.3
RVG150	0.048	0.0128	0.0375	18.3	820	22	17.9	106.9
0.050 crossfeed; 0.0015 downfeed								
D150	0.072	0.0172	0.0536	19.5	620	31	11.0	38.6
SNDMU	0.072	0.0119	0.0605	32.5	600	54	14.9	61.5
SNDMT	0.072	0.0134	0.0583	27.1	660	41	10.0	—
RVG150	0.072	0.0105	0.0610	35.8	760	47	12.1	59.0
0.042 crossfeed; 0.002 downfeed								
D150	0.048	0.0161	0.0365	14.0	670	21	14.0	44.7
SNDMU	0.048	0.0109	0.0408	23.4	760	31	14.1	43.8
SNDMT	0.048	0.0086	0.0426	32.3	690	47	15.2	41.2
RVG150	0.048	0.0109	0.0416	23.2	708	35	13.9	34.8

CONDITIONS: Wet grinding of 44A carbide, 3x6 in., with 5x3/16x1¼-in. D1A1 wheels. The spindle speed of 4200 rpm (5500 sfpm) was chosen to simulate 6-in. wheels operating at 3600 rpm (5650 sfpm). Table speed 45 fpm.
WHEELS: Diamond grades and grits in the wheels same as Table I.

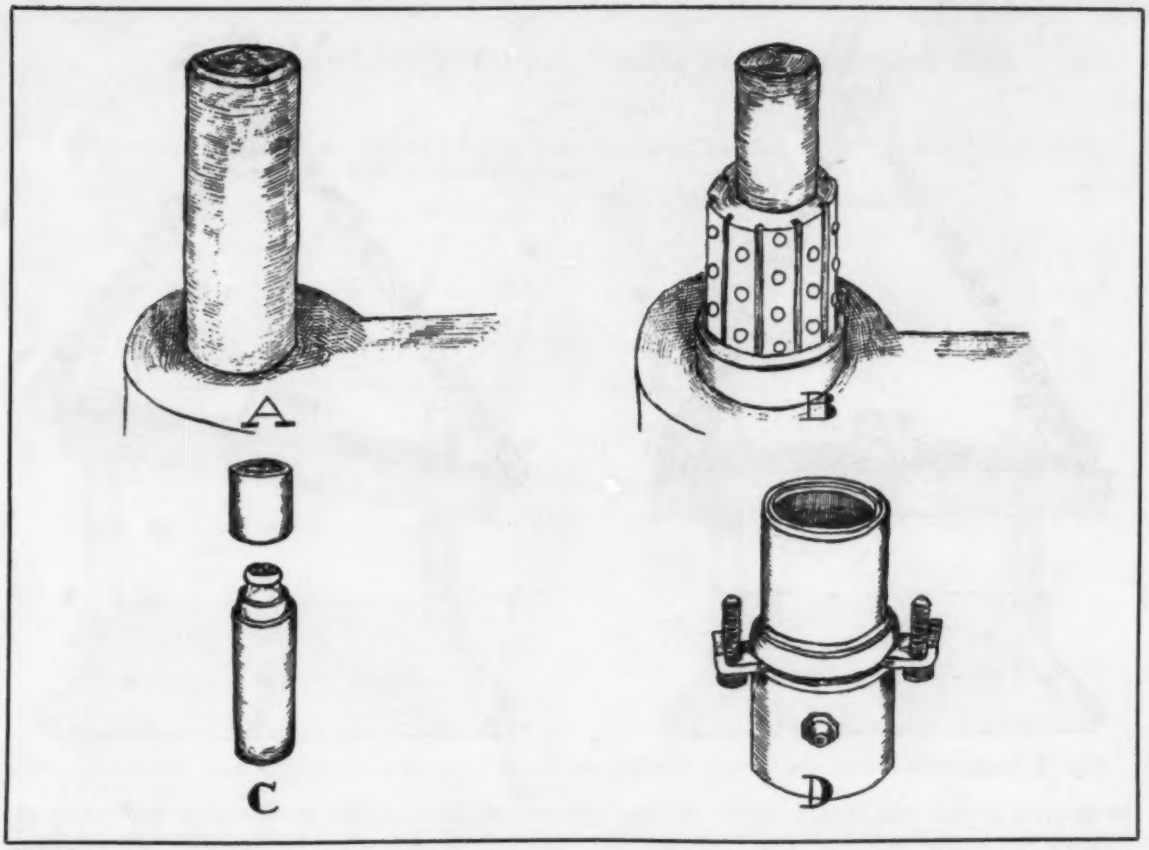


Fig. 1 Critical service items—Periodic inspection and servicing of leader pins is essential to maintain clearances. Common types of leader pins are: *A*—solid-pin, *B*—ball-bearing, *C*—removable cap, *D*—demountable bushing

Maintaining progressive dies

Progressive dies can be real money savers, but only if they are kept in tip-top shape. Here, based on long experience, are basic, detailed tips on how to do the job

By Edward P Boehnlein,
Tool & Die Standards Dept,
Century Electric Co, St Louis

One progressive die can do the work of three to six conventional, single-operation dies. But as the number of stations increases, the progressive die becomes increasingly complex, more costly and more difficult to maintain in A-1 condition.

Take, for example, the basic die set (sub-press) which frequently poses a handling problem because of its size. Here, care must be exercised in the press room and servicing department to avoid bumping, nicking or raising of burrs. Before any die leaves the service department, it should be touched up with a fine mill file to remove protrusions.

And after extensive service, the die sets of heavy-duty dies tend to warp or bow. Because of this, they should be checked periodically with a straight-edge or surface plate to prevent rock, a condition which causes excessive wear of leader pins. These pins should be replaced and the holes rebushed after the die set is resurfaced.

Leader pins

Die sets are equipped with two to eight leader pins, sometimes more. The greater the number of leader pins, the harder it is to keep them functioning properly. But most maintenance problems on all three types of leader pins arise from lack of cleanliness, and from wear and misalignment. Each type of pin has its own peculiarities, however. For example:

- Solid-pin, sleeve-bearing type — Here the major cause of failure is galling of the pin and scoring of the bushing, both of them brought about by lack of lubrication by the press room, or failure to remove grinding dust before assembly in the service department. Galled portions may be stoned or ground if the damage is not too severe.
- Ball-bearing leader pins may have minor defects not easily discovered by visual inspection. Each time the die is serviced, all grease should be washed from the bearings, and cages checked for nicks or burrs which can

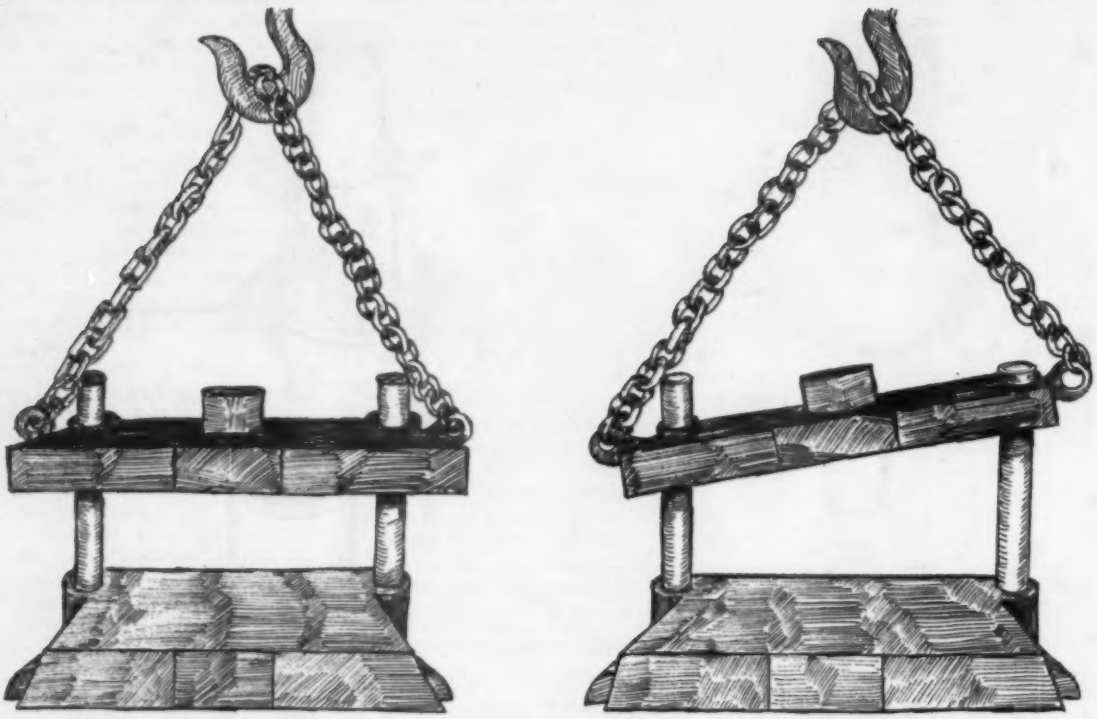


Fig. 2 Straight pull—sling should exert equal pull on leader pins and keep the punch member level while pulling it off

prevent free rotation of the balls. The lock pin and groove (which retain the bearing on the pin) should be inspected to see if anything is impeding smooth operation. Then the bearing should be repacked with clean grease.

• Removable-cap or demountable-bushing pins are not only subject to galling and scoring (like solid pins) but have a tapered interlock which should be checked for dirt or burrs, then securely fastened.

The amount of wear that can be tolerated in leader pins depends upon the individual die. When the die set is new, for example, a 0.0005-in. clearance is common (with a solid pin and bushing), whereas a ball-bearing pin is actually preloaded to a 0.0015-in. press fit. Obviously, the cost of maintaining these fits in service would be prohibitive.

Thus, while it is logical to assume that any variation from these tolerances would make the die set ineffective, such is not the case. Actually, a working compromise must be reached in tolerances for each die.

For example, if a die has various cutting stations and clearance between punch and die elements is 0.002 in. or less, the leader pins would have to be replaced if they show 0.002 in. clearance or more. But if the die has greater clearance, or some self-centering forming and drawing stations, more wear can be tolerated in the leader pins before replacement is necessary.

A periodic check of the leader pins should be made for oval wear, and of the bushings for taper—conditions which are caused by misalignment of the die set or of the press ram. Any such defects should be remedied at once to prevent damage.

Dismantling a die

Care and patience are important in taking a die apart for servicing. If a hoist is used, the sling should be placed so as to exert an equal pull on all leader pins, before the upper member is slowly raised. If this procedure is followed, no trouble will be experienced in dismantling a ball-bearing die set. Even the solid pin type will usually come apart with the same ease.

If the pins bind, the die set should be raised about an inch above the truck or pallet, and then tapped lightly with a lead or soft-face hammer until the two members separate. A die set must never be pounded, nor should a steel hammer be used—such treatment will not only damage the die set, but will cock it even more.

If the pins are tightly bound, the die set should be lowered onto a solid surface, and the member tapped until it slides free.

To assemble the die set, align the leader pins with their bushings and slowly lower the upper member. If the leader pins are the ball-bearing type, be certain that all bearing cages enter the bushings simultaneously.

Sectional dies

Often a die is built in accurately fitted sections doweled or interlocked to a common shoe. Before dismantling the die, check each station for variations in height, depth of offsets or shoulders, and the position of pressure pads and knockouts. Record the figures in a notebook or on a sketch. (These figures are needed for reference when sharpening cutting stations or reworking forming stations, so that all stations are brought back to their original plane.) Failure to take this simple step may lead to production of inferior parts or damage to the die and press.

Normally, the designer of a sectional die will "foolproof" it by staggering dowel pins so that sections fit only one way, or by some similar means. Nevertheless, the conscientious mechanic will study the die before dismantling it. If he has any

Check chart for common faults in progressive dies

Fault

Punches enter die freely and line up when die is in the service department, but bind or shear when set up in press

Possible sources of trouble

- Top or bottom of die set is warped or nicked
- Leader pins are sprung or bent
- One or more of the leader-pin bushings may be sticking or galled, causing deflection of die set
- Uneven or improper clamping of the upper and lower member in the press
- Burrs, nicks or foreign matter on the face of the ram or bed of the press
- Some slight obstruction prevents free movement of the upper member of the die set. Examples: upper member rubbing against some part of press frame; a protruding bolt or clamp; or some auxiliary attachment on the press
- Clamping down the lower member of the die before locking the upper member solidly in place
- Clamping the lower member of the die before entering the punches in the die
- Careless handling in transportation to press room.

Fault

Punches enter die freely and line up before strippers are in place, but not after complete assembly

Possible sources of trouble

- Failure to replace solid stripper in proper place; or damaging the dowel-pin fits in reassembly
- Spring-loaded stripper is not assembled parallel to the die set, causing one edge of stripper to strike die, and deflecting the punches as it attemps to equalize itself
- Careless assembly of spring stripper onto punch clusters, causing misalignment of the punches, or damage to the punch clearance holes
- Improper setting of the starting or running stops (sometimes lets them extend over one of the die openings, preventing the punch from entering)

Fault

Die vibrates, shifts, or pounds in operation

Possible sources of trouble

- Too many perforating or blanking punches contact material simultaneously. Various cutting punches should be set back at least ½ thickness of stock from each other
- Too few clamps on die, or inefficient and improper spacing of clamps
- Failure to lock ram or bolster plate securely Press poorly supported or flooring is weak
- A cutting station in die is jammed with slugs
- Pressure pad, or die cushion, is too strong or is sluggish in operation

Fault

Excessive breakage of small perforating punches

Possible sources of trouble

- Perforating punches are through the material before blanking or cut-off stations contact the work
- Small punches are not supported with proper guide bushings in the stripper
- Lack of lubricant on material

Fault

Material hangs up in feeding

Possible sources of trouble

- Stock table of feeder is not correctly aligned with material guides in die
- Material channel in a bridge stripper may be too shallow, has a sharp edge, or burr at lead in
- Starting or running stops may not retract far enough to clear the channel
- Too much burr on webbing, causing it to hang up

Fault

Misfeeds, run-out or erratic registering of material

Possible sources of trouble

- Material guides in die may be too narrow, or too wide for width of material being used
- Pilots are long, not clear of the die long enough to permit full feed
- Pilots too short, or spring-loaded stripper holds down stock; pilots can't shift material
- Spring-loaded pilots stick in retracted position Pilots hang in blank, pulling it partly out of die
- Pilots of unequal length may cause the longest one to be overloaded
- Slugs pull up partly above die face, causing momentary slippage of feed mechanism
- Webbing around piece-parts may be too weak, causing excessive curving or distortion of strip
- Die designed with an unbalanced work load, which may weaken the material strip too early

Fault

Jam-ups

Possible sources of trouble

- Lack of lubrication
- Misalignment of coil-cradle and feeder
- Lack of proper guides and control of material
- Failure to remove coil-set from material
- Obstructions prevent rapid disposal of piece-parts or scrap
- Excessive burr on piece-part or webbing
- Chipped, rough or loose punch at a station
- Material is not shed properly by the strippers

doubts as to the fit, he can use commercial marking compounds to identify position of the sections.

Sections should be carefully removed with pry bars or clamps to avoid nicking the parts or springing the dowel pins. All burrs and grit should be removed from reground sections before replacing them.

Stock guides

When a die is set in a press, the stock guides become the principal gaging points. For this reason, the die setter must be sure that coil-cradle adjustments, straightening rolls and feed are set parallel to the stock guides. Failure to observe this rule will cause misfeeds, jam-ups and defective parts. In addition, excessive time will be spent on checking the die itself, whereas misalignment in feeding coil stock is actually the fault.

Obviously, then, the stock guides must be checked periodically for wear, injury or misalignment. In some cases, stock guides are integral with the stripper, or they may be carbide pins fitted in ground holes in the die member. In other instances, the stock guides may be part of a transfer mechanism separate from the die member. In no case, can these guides keep material aligned at all die stations unless kept in adequate repair.

Care of strippers

Solid bridge strippers completely cover the die face. In standard designs, the dowel pins will be snug in the stripper and a slide fit in die holes. If these conditions do not exist at first dismantling of the die, polish a few tenths from the protruding ends of the dowel pins or lap the die holes, until a sliding fit is obtained.

Obviously, when the stripper is separated it must not be pried off in such a way as to spring the dowel pins or bend the stripper. If trouble is encountered in removing the stripper at a later date, check the part for burrs or dirt.

Wear in the channel on the underside of the stripper occurs from continuously shedding the webbing or part. Remedy this condition as soon as possible to prevent jamming. Also, if the side walls of the channel serve as a stock guide, mill out the worn side and install a liner.

Some bridge strippers have hardened bushings to align and support punches. The fit is very close. Therefore the punch may be galled, or the insert scored from lack of lubricant

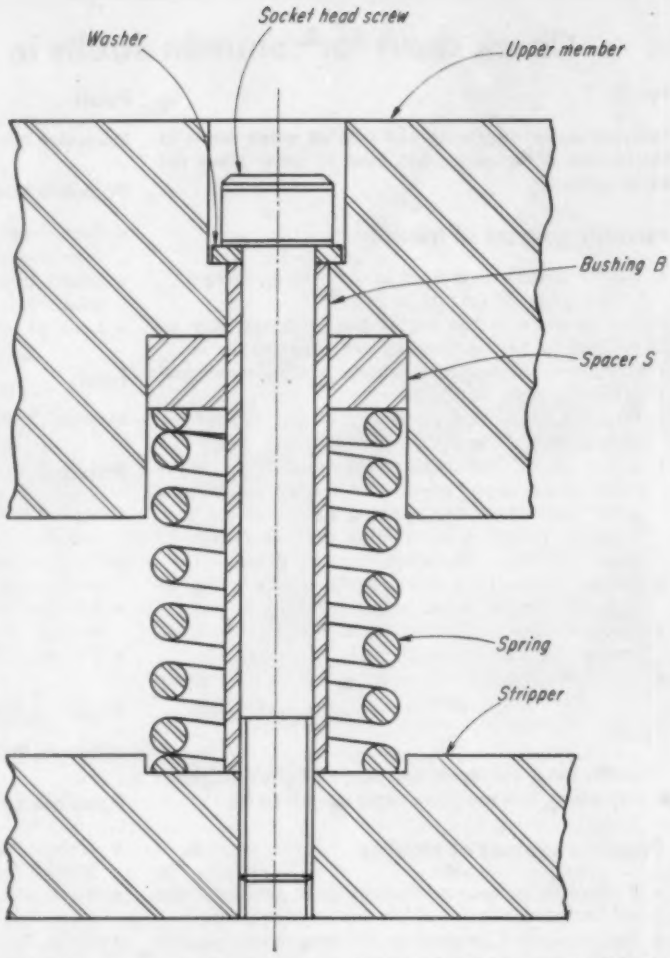


Fig. 3 **Stripper spring adjustment**—as much stock should be ground off bushing *B* and spacer *S* as off the punch. This trick maintains proper spring pressure throughout the life of the punch

or the presence of grit and metal flakes. When these wear conditions appear, apply maintenance procedures such as suggested for galled leader pins.

Special care must be taken to return any starting or running stops to their proper position, when replacing a stripper. See if the stops operate freely. If worn, they can ordinarly be repaired by welding and reshaping.

Spring-loaded strippers are usually attached to the punch cluster and are aligned by the punches. In other cases, spring strippers are aligned by separate leader pins or by the die set's leader pins. When positioned by leader pins, a spring stripper can be fitted more accurately to the punch shapes. Then it serves as a bridge stripper to align the punches with the die.

Despite the many advantages of a spring stripper, the springs are a major service problem. Any broken spring must be replaced—but the mechanic should first receive authority from someone fully familiar with the design principles empolyed in the die.

Periodic inspection determines if springs have become bent, deformed or set. Stand all the springs of similar size on a surface plate or other flat surface, and note if they will stand without toppling. Those that do not stand erect should be replaced.

Salvage the old springs by grinding the ends square and pairing them in sets for future use. When all springs in a group are standing, a scale or straight edge is laid on top of them, to determine if they are all of the same length. Any springs that are 1/16 inch or more shorter than the rest should also be replaced.

As the punch length decreases

from grinding, check the springs to make sure they are not compressed beyond their elastic limit. When this does occur, the simplest remedy is to install shorter springs—a step which is not recommended, however, because free travel decreases, and this may lead to trouble. Whenever possible, take time to increase depth of spring holes and maintain the original spring length.

In some cases, a stripper may be designed with spring pockets and shoulder screws (Fig. 3).

By reducing the length of bushing *B* and the thickness of spacer *S* proportionately with the amount ground off of the punches, the original length and proper spring pressure can be maintained throughout the life of the punches.

When a spring breaks, it usually distorts or burrs the spring hole. Therefore, all spring holes should be checked and kept clean, to make sure that the spring moves freely.

In some instances, strippers loaded with 40 or 50 springs have actually had fewer than 25 springs producing the required pressure. The rest were too short, were binding, or had taken a set.

All shoulder screws must be of equal length to assure parallelism of the stripper. The body of the screws and the holes they slide in must be free of burrs and grit, and thoroughly lubricated to prevent sticking or galling.

Constant use tends to pit, wear or deform the face of the stripper, a condition which can be corrected by resurfacing. If ignored, it will tend to mar the piece parts, and will also cause jam-ups, because of improper shedding of the material from the punches.

In replacing a spring-loaded stripper on the punch cluster, align it carefully so as to prevent damaging the punch cutting edges, or binding, which throws the punches out of line. When the shoulder screws have been fitted snugly, check the stripper to determine if all springs are in their pockets; and that the stripper is parallel, and extends at least 1/32 inch above the perforating punches.

Maintenance of pilots

Pilots can be either of the solid or disappearing type, but some servicing problems are common to both. For instance, pilot size should be checked and original size maintained throughout the life of the die. If the pilots show wear of more than 0.002 in., they should be replaced.

Pilots should be kept highly polished, and the nose or lead must be concentric with (and blend perfectly into) the body size. All pilots must extend an equal distance above the punches at their body diameter, in order to enter the material simultaneously.

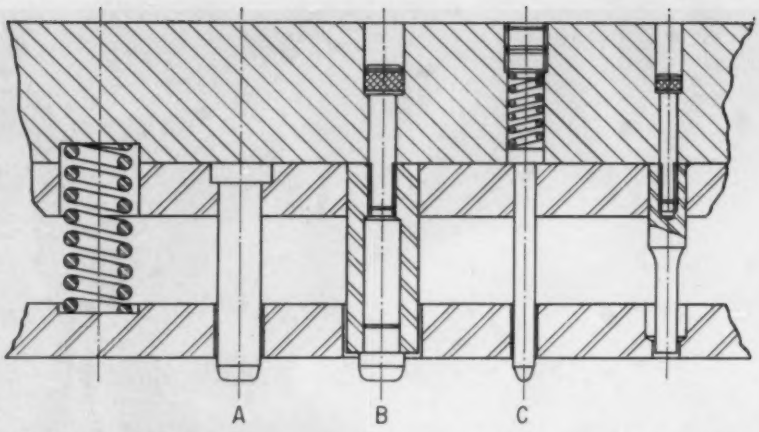


Fig. 4 Maintaining pilot size—Pilots should be replaced if worn 0.002 in. Body diameters should protrude sufficiently to enter the pilot holes in stock for registration purposes, before the stripper contacts the material. Types of pilots are: *A*—solid, *B*—inserted, *C*—disappearing. Their position in the stripper is shown in relation to a perforating punch

As the punches in a die become shorter, the pilots must be shortened accordingly. This can often be done either by grinding off the back of the pilot, or by removing shim washers under the head. Neither method is recommended. Good practice dictates regrinding the tapered nose. In this way, a fresh body diameter is assured and the size is simpler to maintain.

Pilots should be periodically checked (especially after mishap in the press) to make sure they are not sprung or bent. If distorted in any way, they should be replaced rather than repaired. Replacement cost is minor compared to the possible expense on die and piece parts, if the repaired pilot fails to function properly.

The body diameter of a pilot should extend beyond the punches by at least 1½ times the thickness of the stock on the thinner materials, and betwen 1/8 and 5/32 inches on the heavier materials. When a pilot extends beyond these limits, there is danger that it will snag in the hole of the material and will pull up the blank or the webbing. If the die is fed automatically, such a pilot may not be clear of the material long enough to allow proper feed length.

Special attention must be given to disappearing pilots. Because the slide fit pilot must be close, watch for sticking or galling. When these conditions appear, repair the pilots in the manner suggested for galled leader pins.

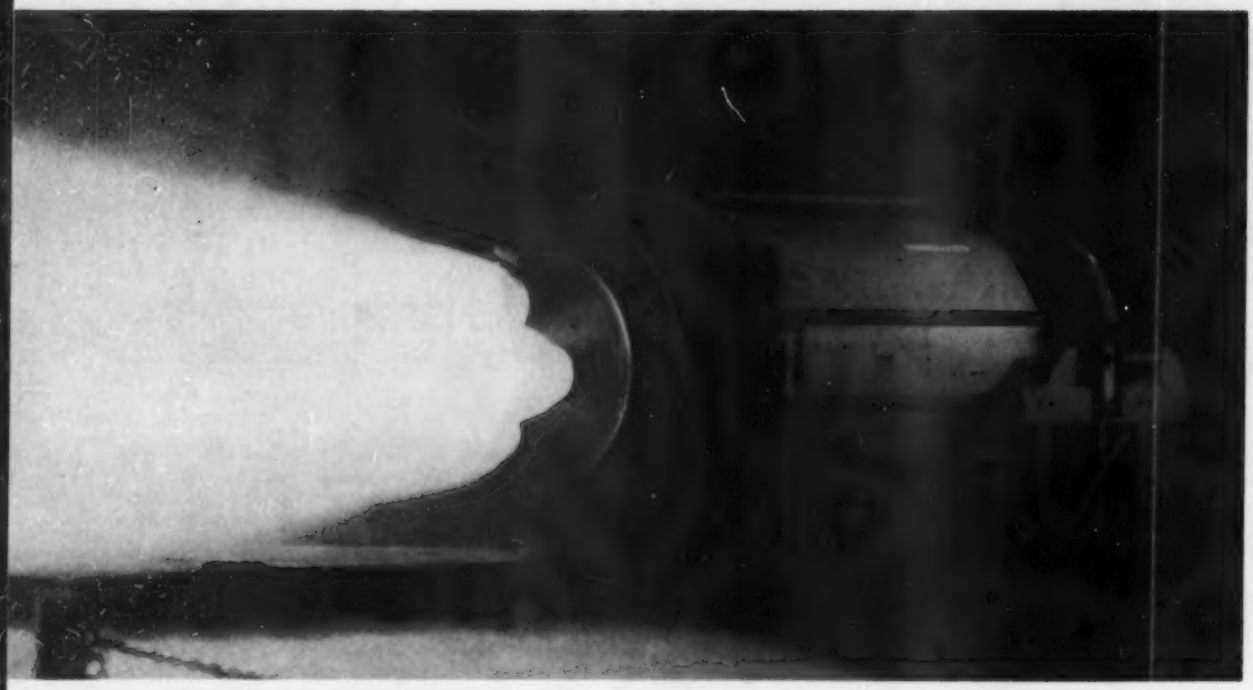
On a new die, the springs in the pilots are designed with the proper tension and free travel. Each time the die is serviced, remove the pilots and springs from the die. Carefully check each spring, its pilot, and the hole; clean thoroughly, lubricate, and replace.

One final word: When a spring-loaded stripper has been replaced on the punch member, make certain that the body diameter of the pilot extends beyond the stripper, because the pilot must register the material in its proper position, before the stripper acts and prevents the material from shifting into place.

Necessary tools

Dismantling and reassembling a progressive die are simple tasks, if common sense and the proper tools are used. Each repair man should have:

- A set of socket-type capscrew wrenches.
- Various sizes of screw drivers.
- One or more sets of pry bars.
- A copper-, lead-, plastic-, or nylon-faced hammer, or soft faced tappers (to be used whenever possible instead of a steel hammer) to prevent marring or nicking of the die parts.
- A set of punches in various diameters and lengths. A good variety of punches is essential to prevent a common service department error—trying to remove a tight dowel pin or pilot with a drive punch that is too small in diameter or too long. •



Hot edge-upsetting paves the way

Welding Polaris missile cases

Hot edge-upsetting methods worked out early in World War II are again coming into their own to reinforce welds in Polaris fuel chambers. Result: no weld failures

By R D Libert
Manager of manufacturing
Space-Ordnance Division
A O Smith Corp

Nowhere is reliability as vital as in a missile, and nowhere is it as hard to achieve. This is especially true in the welding of highly stressed thin-walled vessels. The fuel chamber for the Polaris missile is a case in point.

But it has taken a hot edge-upsetting technique worked out early in World War II by A O Smith Corp to virtually eliminate weld failures. The method was originally designed to strengthen weld seams in such thin-walled vessels as torpedo air flasks.

Edge-upsetting reinforces the weld area so much that the parent metal fails before the welded joints do in tensile tests, or when finished vessels are tested to destruction in burst chambers.

Not only are weld joints extremely unlikely to fail after edge-upsetting, any defects that do occur are easily discovered by routine Magnaflux, fluorescent penetrant, or x-ray inspections—because the surface of the weld can be ground without affecting the thickness of the parent metal.

For example, the weld deposit is subject to a stress of only 120,000 psi in welded vessels containing a 50% reinforced weld and stressed at 180,000 psi in the parent metal.

Determining reinforcement

Degree of reinforcement normally is dictated by the ratio of design allowable strengths between the parent metal and weld deposit at a specified heat-treat level. It seldom exceeds 50%.

It is also dictated by the location of the weld in the wall of the vessel. Barlow's law (hoop stress in an internally stressed cylindrical vessel is twice the longitudinal stress) indicates that longitudinal weld seams in such vessels would normally require twice as much reinforcement as circumferential weld seams in the same units. But by the same reasoning, this almost without exception precludes the necessity of reinforcing the circumferential weld area.

For the Polaris missile chambers (now being made at an A O Smith plant in Milwaukee for the U S Navy, under subcontract from Aerojet-General Corp) only the two longitudinal seams are reinforced.

Thickness of sections along each end of the steel sheets from which the chamber sections are roll formed is doubled by hot-upsetting in a specially rebuilt 3000-kva (50-sq in.) resistance flash welder. Only one end is upset at a time.

For upsetting an end, the carefully-inspected sheet is lifted with an overhead hoist, fitted with a vac-

uum grab, to the table at one end of welder. It then is pushed manually through large hydraulically actuated clamps into two pairs of 74-inch-long upsetting jaws and against a locating backup bar.

The outer pair of upsetting jaws are machined with shaped grooves which form the upsetting die cavity. Electrical contact with the steel sheet is improved by flat-braided copper cables inset into a longitudinal groove in the face of each upsetting jaw.

Hydraulic cylinders, placed vertically in line across each of the pairs of upsetting jaws and along each side of the large backup clamp above the machine table, are actuated to hold the sheet solidly in place while a section 6 inches from the end of the sheet is heated to 1900 F and upset.

Operation is fast

When upsetting heat is attained, an automatic time switch actuates solenoid valves to traverse the machine head hydraulically, forcing the two pairs of jaws almost together and pushing the hot steel sheet section into the long cavity in the outer pair of jaws. Once the sheet is in position, clamping, heating and upsetting require only a few seconds.

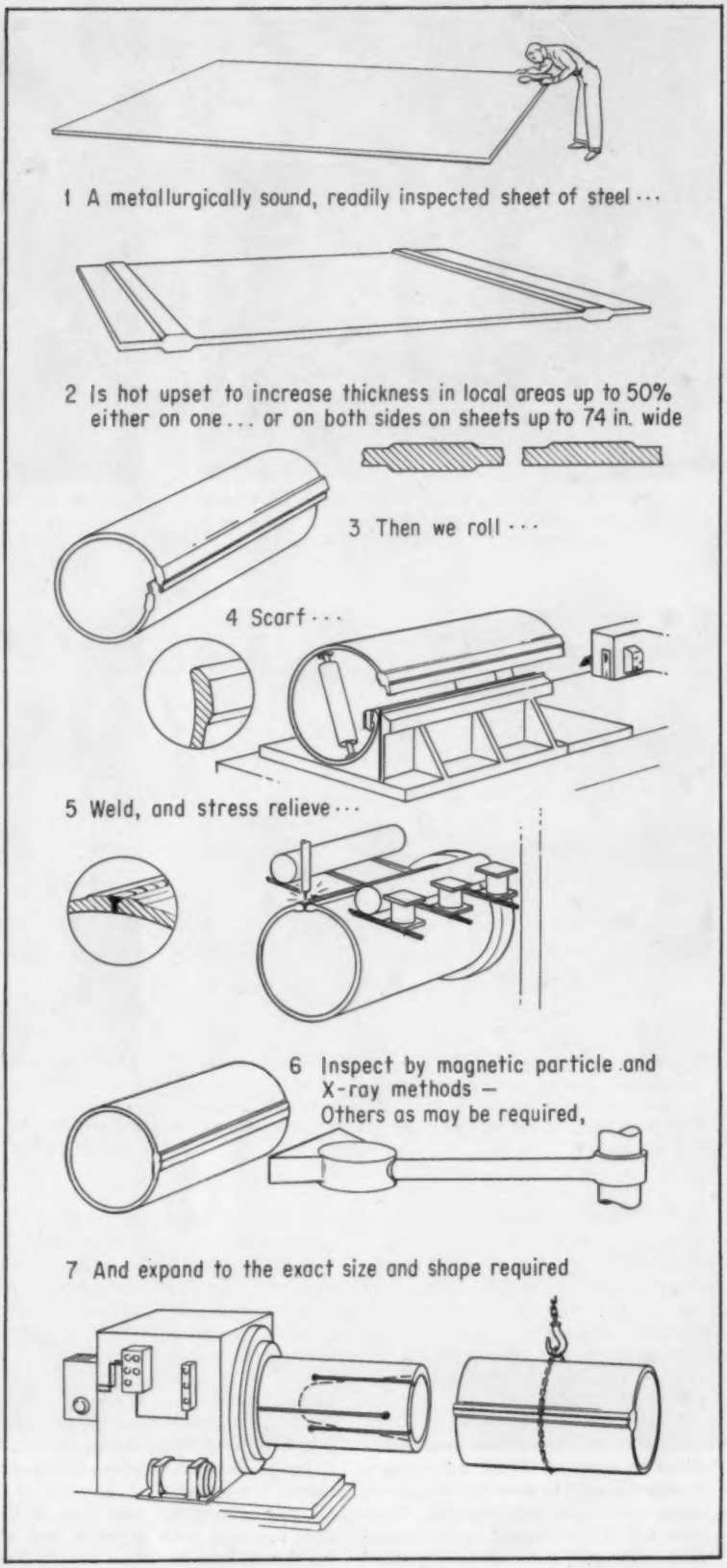
Upset sheet ends are annealed individually in a butane gas-fired furnace; then the upset areas are surface ground to a predetermined thickness, leaving reinforced ridges at both ends on both sides of the sheet. The amount of buildup on either or both sides of the sheet is governed by the die cavity in the upsetting jaws.

Roll forming of cylinders

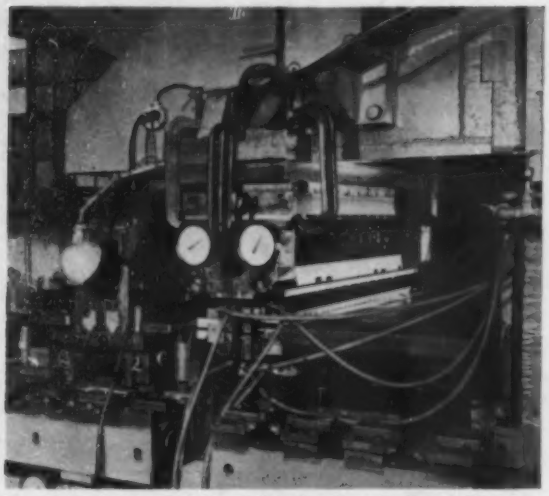
After the reinforced areas at each end of the flat sheet are surface ground, the sheet is roll-formed to produce a 54-inch OD cylinder, two of which comprise the body of the Polaris chamber. Careful control of the grinding operation is essential.

HSS parting and form tools in the square turret of a Gray openside planer (from which the cross rail has been removed) cut off the crop end and form plane the required scarf shape at each end of the roll-formed sheet, working on one end at a time. A special welded-steel fixture positions the workpiece for these scarfing operations, and the cylinder is located according to qualifying lines scribed at each end when it is inspected after rolling.

Formed and scarfed missile case sections are cleaned all over by grit blasting, then are mounted one at a time in the fixture of a longitudinal seam welder designed and construct-

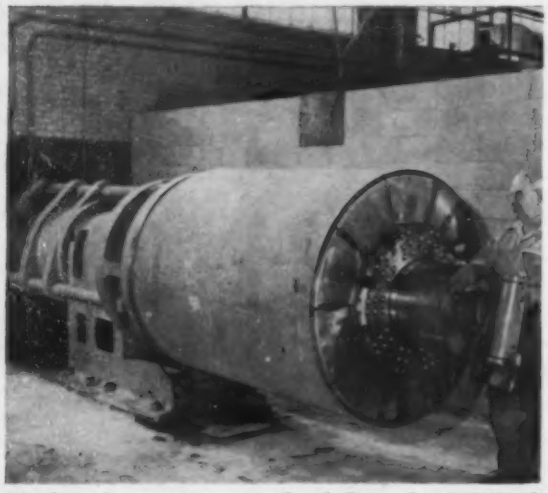

1 A metallurgically sound, readily inspected sheet of steel · · ·
2 Is hot upset to increase thickness in local areas up to 50% either on one . . . or on both sides on sheets up to 74 in. wide
3 Then we roll · · ·
4 Scarf · · ·
5 Weld, and stress relieve · · ·
6 Inspect by magnetic particle and X-ray methods — Others as may be required,
7 And expand to the exact size and shape required

Welding Polaris missile cases . . .



Rows of Blackhawk industrial hydraulic cylinders hold 74-in. long die inserts and holding clamps down against thin sheet of steel while reinforcement ridge is heated and upset 6 inches from end of sheet.

Designed and built by A O Smith to use either Tig (Heliarc) or submerged arc (left) heads when welding longitudinal joints in vessel walls, this fixture is controlled from catwalk so operator can easily observe weld as it is made



Ten formed jaws move outward radially in this A O Smith developed expander for sizing thin steel Polaris missile case sections to specified 54-in. OD. Intensifier at right controls final sizing

Final tapping operations in flange faces are performed on vertically-positioned fuel chambers with Walker-Turner radial drill and Smith & Weize tapping head. Flanges are hard (Rh 47 to 54C), so speed is slow

ed in the A O Smith shops. First pass with the Heliarc welding head is made at 5½ ipm—succeeding passes are traversed at 12 ipm. Number of passes required for a finished joint depends upon the thickness of the reinforced section. The weld area is cleaned thoroughly with a wire brush after each pass.

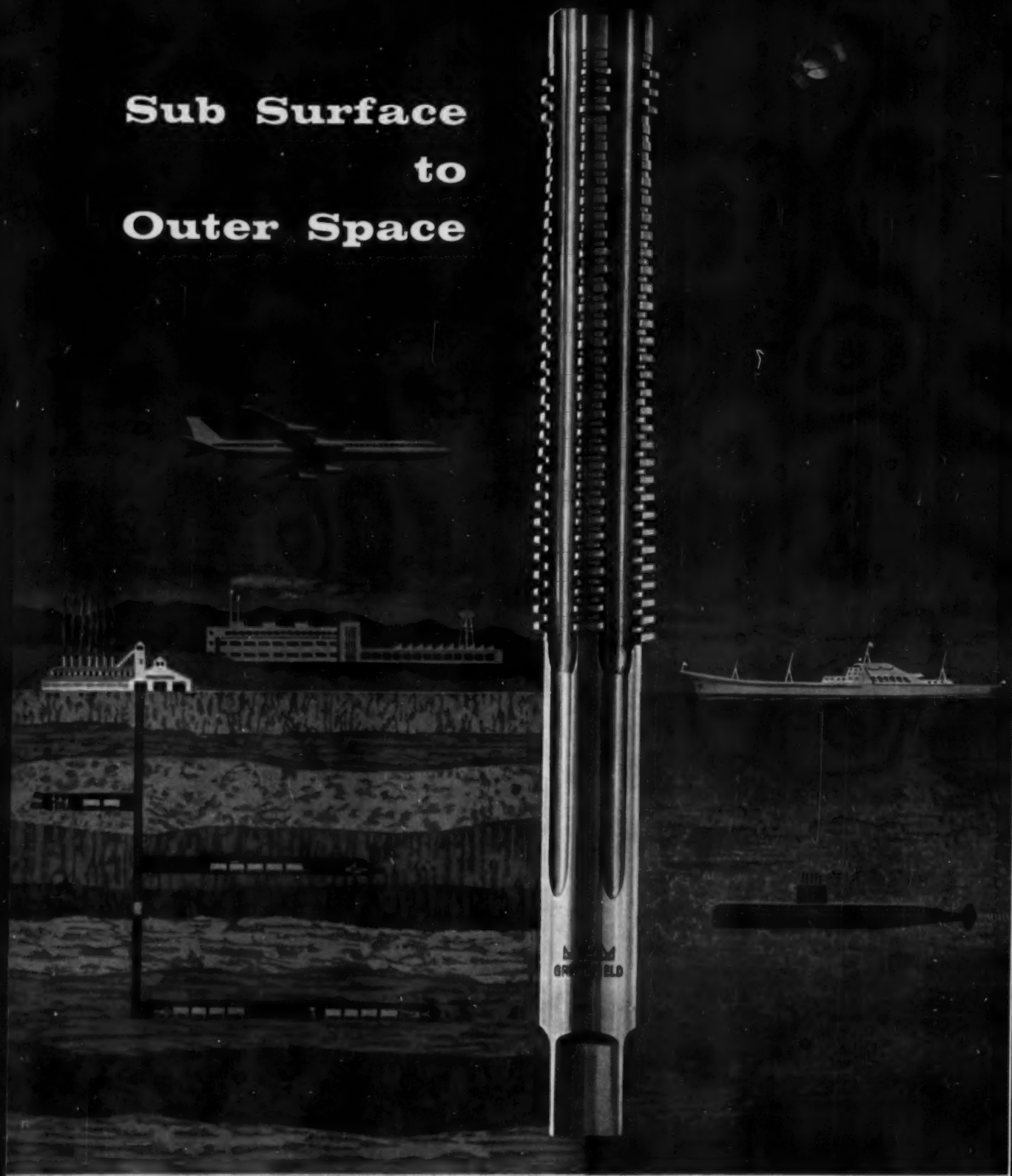
Seam-welded case sections are suspended in pairs on wire racks and stress relieved at 1250 F for 4 hours in electrically heated pit furnaces, using inert gas atmosphere. They then are blast-cleaned with aluminum oxide grit, and manually ground and polished along the weld seams inside and out, in preparation for qualifying the welds with x-ray, Magnaflux and DyChek inspections.

Later, these case sections are normalized at 1200 to 1400 F in a 14-hour cycle, using the same electric pit furnaces as those for stress-relieving operations. Then they are expanded to 54-inches OD, to within a tolerance of 0.030 inches, in an A O Smith-designed, hydraulically-actuated expander.

Later operations join two of the case sections with forward and aft bulkheads into the basic Polaris fuel chamber, (using another A O Smith-designed and constructed welding machine). This unit is of particular interest because it incorporates a 100-kva, 60-cycle induction heating coil which can move along the bed for stress-to-stress relieving the circumferential welds.

Following a series of welding operations (for attaching flange and skirt rings) rough machining operations, and qualifying inspections (after each welding operation), the assembled chambers are hardened, quenched and drawn in large vertical furnaces, then finish machined. •

Sub Surface to Outer Space



Under or on the surface of the earth, in the air or in outer space, screw threads are vital to man's ability to live, move or work. Strip his inventions of screw threads and he would return to a village handicraft existence. Yes, it would be hard to overstate the importance of screw threads in our modern world, and equally hard to imagine generating internal screw threads efficiently without taps. If you use either standard or specially designed taps for products on which men's very lives depend, can you afford to use any but the best?

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Erie C-frame hydraulic presses have all steel welded frames to assure a high safety factor with minimum deflection. Power units are built in. Sensitive controls include dual hand and foot levers to provide accurate operation in either direction.

For the complete story, phone or write Mr. Carl Hammon, Erie Foundry Company, Erie 1, Pa. Ask for Bulletin 370.

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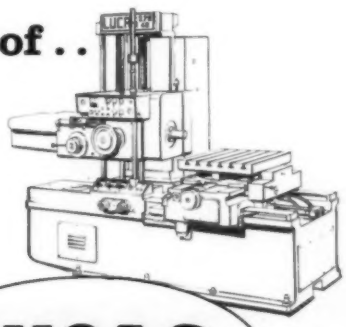

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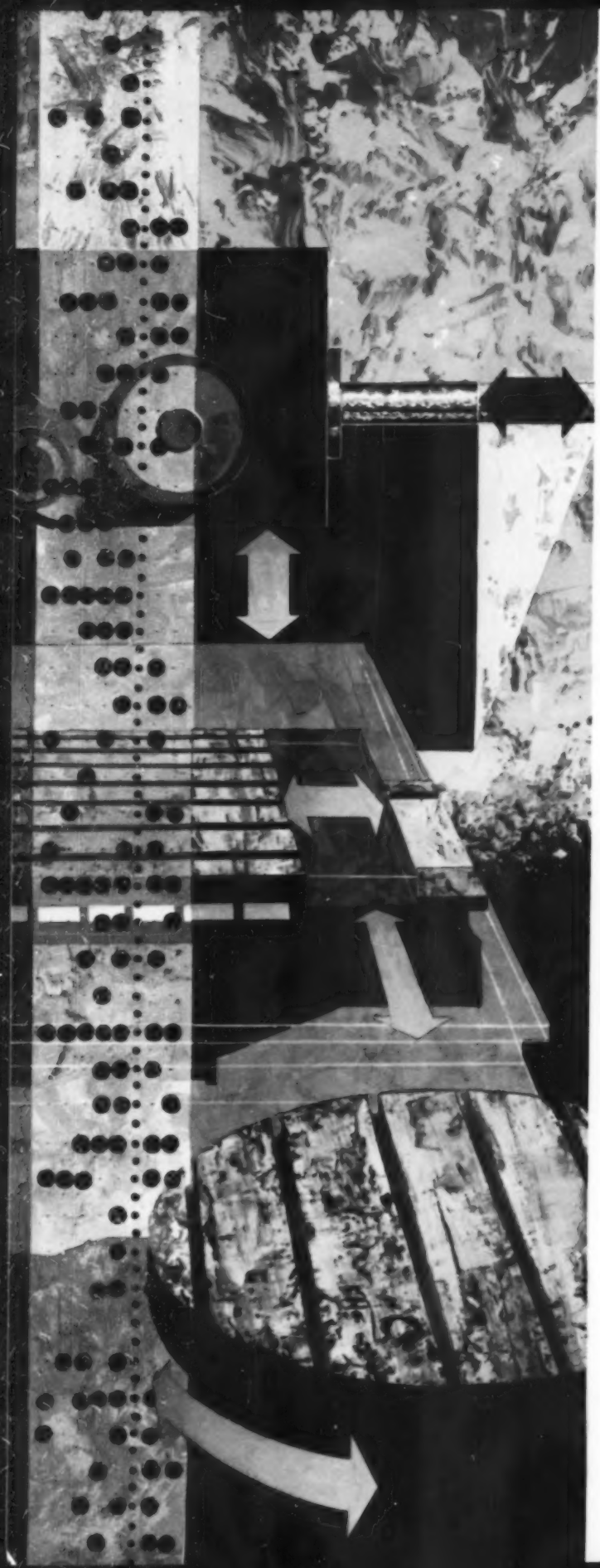

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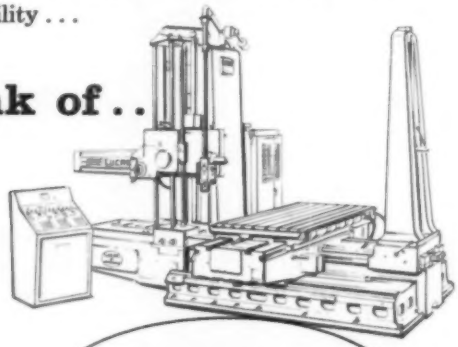

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American Machinist / Metalworking Manufacturing

REFERENCE BOOK SHEET

Single-Point Thread Chasing—I

By Warren G Ogden, Jr, manufacturing feasibility engineer, Raytheon Mfg Co, Lowell, Mass

Whenever a toolmaker or modelmaker prepares to chase a thread in an engine lathe, he must know how much to truncate the toolbit. And if he is going to cut an internal thread, he must know what diameter to bore the hole before threading. The only information listed in handbooks is the depth of an external thread. Actually, he wants 83 1/3% of this depth for an internal thread. If he knows this, he will not find the information tabulated anywhere else in useful form.

Sometimes the toolmaker prefers to feed the tool into the cut at a 29° angle, by means of a compound rest. This depth must also be computed. Or again, the toolmaker wishes to use a toolbit with a theoretically sharp point, particularly with fine pitches. Once more, he must calculate the depth of cut, either to feed straight in or at 29° to the work.

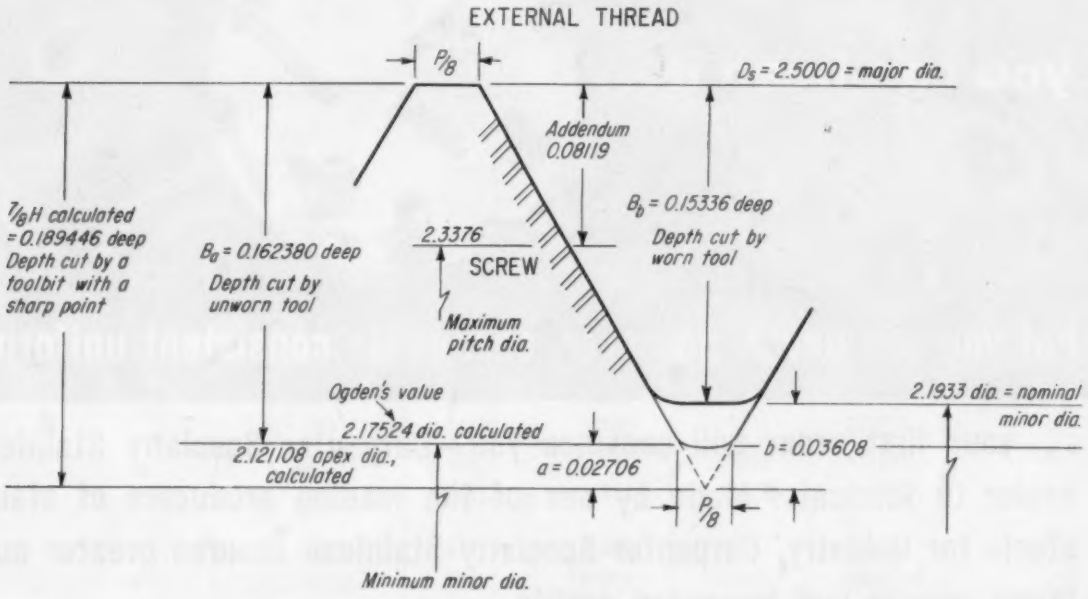
What about class of thread? Usually this matter is of little concern. The toolmaker wants a good fit, with no shake, in most cases. If he is concerned with class of thread, he must achieve final size with thread gages or other means.

Two tables are presented. The first one, on external threads appears on page 99. The second one on internal threads will be published in a subsequent number.

These tables and the sketches are based on thread data in Table 111.1 in Handbook H 28 (1957) — Part 1, as published by the U. S. Government. The sketches aid one to visualize the meanings of the table headings. Of course the tables and sketches are based on design-size profile, where the screw and nut have one identical pitch diameter, or metal-to-metal fit. Under these conditions, you have "Ogden's value" (for want of a better name) as shown on the sketches.

These diameters have no bearing on class of thread and are only 0.005 in. away from the true diameter for coarser pitches and as you approach 80-pitch threads, the "Ogden's value" approximates the true diameter.

The tables can be used for both the Unified and American National thread forms.


EXTERNAL THREAD
P/8
D_S = 2.5000 = major dia.
Addendum 0.08119
7/8H calculated = 0.189446 deep Depth cut by a toolbit with a sharp point
B_a = 0.162380 deep Depth cut by unworn tool
2.3376
SCREW
Maximum pitch dia.
B_b = 0.15336 deep Depth cut by worn tool
Ogden's value
2.17524 dia. calculated
2.121108 apex dia., calculated
a = 0.02706
b = 0.03608
2.1933 dia. = nominal minor dia.
P/8
Minimum minor dia.

Example: to chase a 2½ — 4 UNC external thread

Problem 1 — Determine toolbit truncation a on an unworn tool, and b for depth of $\frac{17}{24}$ H

Solution: $a = 0.02706$ (See col. 3 in table) $= \frac{H}{8}$

$b = 0.03608 = \frac{H}{6}$, where H = height of sharp V thread $= 0.86603 \div n = 0.21650$ for $n = 4$

Problem 2 — Given maximum major dia of screw, calculate the 90° infeed of the toolbit for the variants above.

Solution $B_a = h_b = \frac{3}{4} H$, Fig 111.1, col 13 of Handbook H 28 (1957) — part 1.

$= 0.162380$

$B_b = h_a = \frac{17}{24} H$, Fig 111.1, col 12 of Handbook.

$= 0.15336$, or the minimum depth or maximum material condition.

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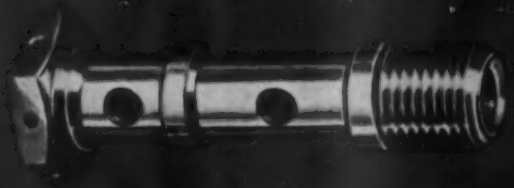

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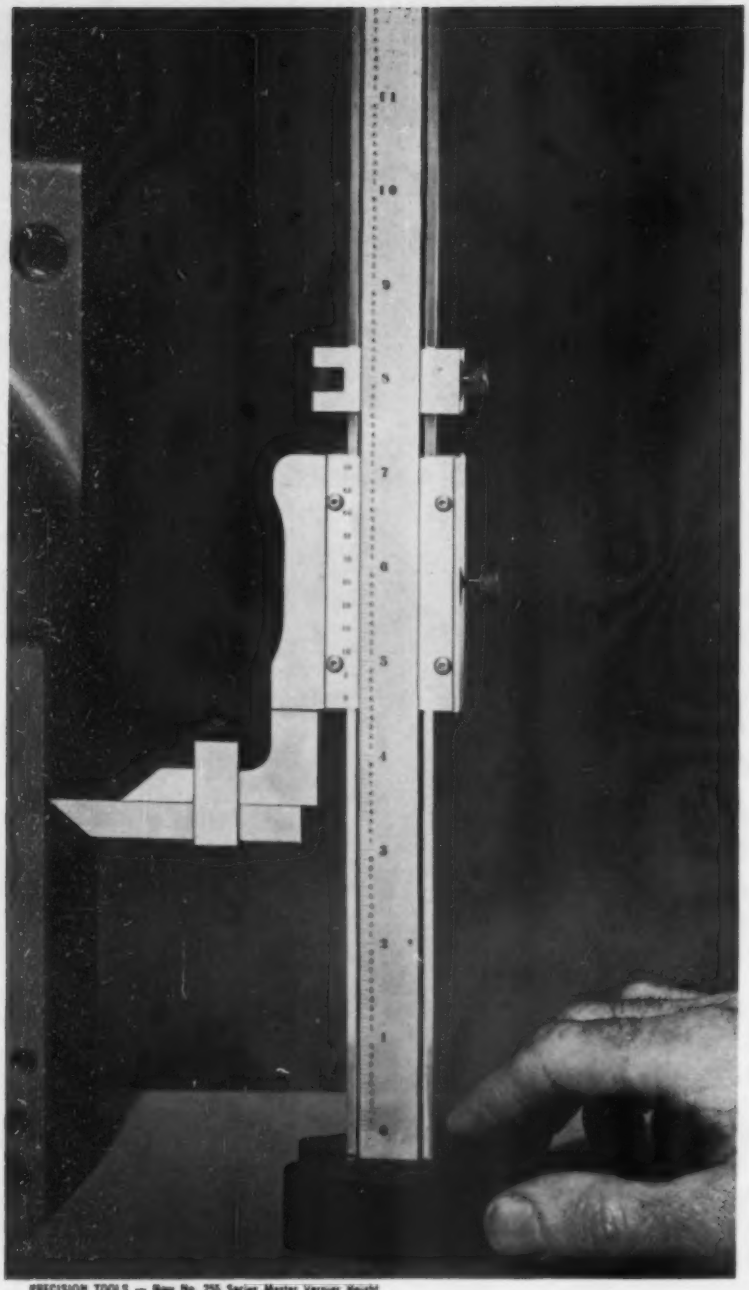
CIRCLE 215 READER SERVICE CARD

Single-Point Thread Chasing—II

SINGLE POINT THREAD CHASING IN A TOOLROOM LATHE EXTERNAL THREADS ONLY UNIFIED THREAD FORM				IF TOOLBIT IS NOT TRUNCATED Theoretical sharp point	
THREADS PER INCH n	INFEED at 90° to the MINIMUM MINOR DIAM.	INFEED at 29° to the MINIMUM MINOR DIAM.	DEPTH of TOOLBIT TRUNCATION	INFEED at 90° to apex of fundamental triangle	INFEED at 29° to apex of fundamental triangle
	inch	inch	inch	inch	inch
80	0.008119	0.00928	0.00135	0.00948	0.010825
72	.009021	.01031	.00150	.01053	.012028
64	.010149	.01161	.00169	.01184	.013532
56	.011599	.01326	.00193	.01354	.015465
48	.013532	.01547	.00226	.01578	.018042
44	.014762	.01688	.00246	.01722	.019682
40	.016238	.01857	.00271	.01894	.021651
36	.018042	.02063	.00301	.02105	.024056
32	.020297	.02320	.00338	.02368	.027063
28	.023197	.02651	.00387	.02706	.030929
27	.024056	.02751	.00401	.02807	.032075
24	.027063	.03094	.00451	.03157	.036084
20	.032476	.03714	.00541	.03789	.043301
18	.036084	.04125	.00601	.04210	.048113
16	.040595	.04641	.00677	.04736	.054127
14	.046394	.05304	.00773	.05413	.061859
13	.049963	.05712	.00833	.05829	.066617
12	.054127	.06189	.00902	.06315	.072169
11½	.056480	.06458	.00941	.06590	.075307
11	.059047	.06752	.00984	.06889	.078730
10	.064952	.07426	.01083	.07577	.086603
9	.072169	.08252	.01203	.08420	.096225
8	.081190	.09283	.01353	.09472	.108253
7	.092788	.10609	.01546	.10826	.123718
6	.108253	.12377	.01804	.12630	.144338
5	.129904	.14852	.02165	.15156	.173205
4½	.144338	.16503	.02406	.16839	.192450
4	.162380	.18566	.02706	.18945	.216506



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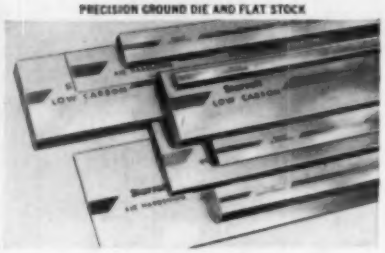
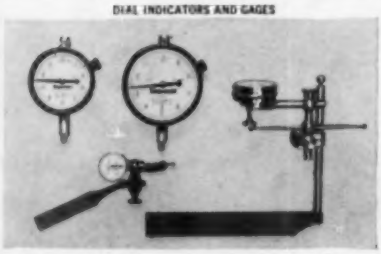


HACKSAWS, HOLE SAWS, BAND SAWS, BAND KNIVES

DIAL INDICATORS AND GAGES



Talking Shop

Safety Gimmick

"GOOD MORNING, this is the plant calling. Your husband's name has just been drawn in this month's safety quiz and he has won three silver dollars, plus a fourth because he was wearing safety shoes today. Now if you can tell us this month's safety slogan we will mail you a check for *five* dollars."

That conversation, which we made up, could actually take place because that is the way Allis-Chalmers is extending its "total safety" program into the home. And we'll be willing to bet that most wives know, each month, what this month's home safety slogan is.

Since the campaigns started three years ago A-C accident frequency rates have reached new lows. Now the campaign is being extended to the home, because that is often more dangerous than the plant.

Assembly by Microscope

A HEARING AID that weighs one-third of an ounce (including the battery) has been developed by Zenith. The transistorized unit is so small that assembly must be done under a microscope.

So What's New?

SPARK DISCHARGE FORMING was done back in 1908. The work was forming of tubes under water with circuits similar to those used today, according to Arthur Der Derian of Westinghouse. He also adds that the 4-in.-thick steel turrets of the Maginot Line were formed explosively. To which Jack Ottestad comments that they were also explosively deformed.

New Theory

WHY DOES ONE METAL form a good nucleus around which another metal can crystallize? The general theory has been that it happens because the crystal structures are similar. Now two scientists at the Illinois Institute of Technology, working under a National Science Foundation grant, dispute this.

Dr. L F Mondolfo and Dr B E Sundquist say that one material makes a good nucleus because its surface energy is higher than the crystallizing material. They found that where one material is a good nucleus for another, the reverse is impossible. Tin is a good nucleus for lead, but lead is no good for tin.

An incidental result is a new explanation for rain-making by cloud seeding. People have been using the right material (silver iodide) but for the wrong reason.

Follow Through

TRAINING in screw-machine maintenance has long been a standard practice at Brown & Sharpe, where Oscar Lippman gives training to customers in Providence. Recently he completed four training sessions on the West Coast and is now giving the course (one week each) in Plymouth (England), Copenhagen, Stockholm, and Goteburg.

Rumble Seats

AUTOMOTIVE CUSTOMERS seem to be filled with nostalgia. Not long ago we learned that Imperial put out a model with a small oval rear window. A production bottleneck soon developed filling the orders for small rear windows.

Now we hear that an enterprising Studebaker dealer near Chicago displayed at a 1920's revue a Lark with a rumble seat he had built into the trunk space. He immediately received six orders for the special models.

The Goat

EVERYBODY has surely heard that a camel is a racehorse designed by a committee. Now comes a new definition of committee: the unwilling picked from the unfit to do the unnecessary.

Quote

"SO MANY MEN in industry are looking for park benches along the road where they can sit and rest. But the only park benches I know of are immediately in front of the undertaker's place. There is no spot in an industrial situation where you can sit down and rest. It is a question of change, change, change all the time. And it's always going to be that way."—Charles F Kettering.

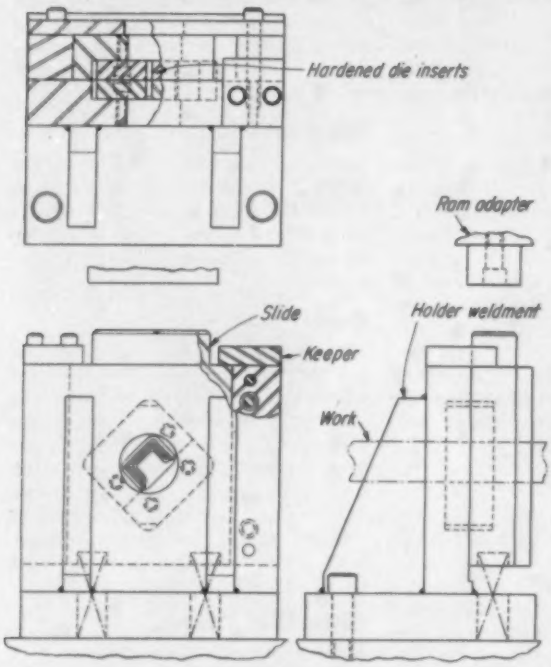
Grab That Tank

MOST EXPLOSIVE FORMING is done in tanks sunk in the ground some distance from the plant. Many companies have found that the explosive acts like a pile driver. Each shot drives the tank a little deeper so that collars have to be added at the top.

This problem was solved at GE by putting the tank on a gravel bed placed at the bottom of the hole. The blast sinks the tank about 1⅜ in. into the gravel. Unfortunately it rebounds 1½ in., so that from time to time it is necessary to dig a hole in the gravel to resink the tank. •

Practical Ideas

Die Cuts Channel Stock Without Distortion



Parts of various lengths, made from 1⅛ x 9/16 x 3/32-in. bar channels, were needed in large quantities and were planned to be cut off in a punch press. However, because a conventional cutoff die would cause too much distortion, the one illustrated was constructed and run in a short-stroke press.

The design was kept simple to hold the cost down, and yet make it possible to change cutting members when a different-size channel had to be cut. And, as the slide has a short movement, it was left soft except for the upper end, or striking surface, which was flame hardened. To avoid adjustments, a one-piece keeper was used and the mounting and stop surfaces for it were ground flush at assembly, thus cutting fitting time.

As shown in the drawing, the ho'der is a weldment, similar to an angle plate, comp'ete with gussets. A pocket is milled in the face of the upright to receive one half of the cutting members. The other half is similarly recessed in the slide on the same center as the one in the holder. A gib on each side and a retainer plate maintain slide alignment vertically.

Both cutting members are of split construction. They are made in the same shape as the channel and ground together (the bottom of the slide with the bottom of the holder, etc) for the best match possible. Each set of cutters is tightly fitted in their individual pockets and secured with two socket-head capscrews in each half. Dowel pins may be used but aren't necessary if blocks are properly fitted.

The die is shown in loading position as two compression springs push the slide against the keeper. The view at bottom left shows the stock-loading side and the liberal chamfer around the die opening.

M W Loftus, Chicago, Ill

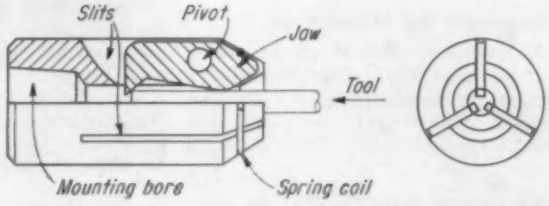
Speed Chuck's Jaws are Self Aligning

There is no need to stop the machine for tool changes, if tools have nearly the same shank diameter, when the illustrated chuck is used. It will drive drills, reamers, counter bores, and even special screws without any more chucking effort than it takes to insert the tools. What's more, its gripping power is directly relevant to the output required; in other words, the more pressure placed on the tool, the greater becomes the grip of the chuck.

Provided with a tapered bore for mounting, the chuck can be fitted to a drillpress or special machine spindle or, mounted on a suitable shank, it can prove valuable in a lathe. A tool within the range of a particular-size chuck is simply pushed into the chuck until it bottoms. A radial spring does the rest—keeping the tool intact before the actual machining operation begins.

Although capacity range is not one of this chuck's outstanding features, a small-size chuck can nevertheless handle shanks from its maximum capacity to 1/32 in. smaller. Larger chucks have correspondingly wider ranges.

Machining the chuck body is a simple job, but one that requires some degree of care. This applies particularly to the tapered mounting bore and its relation

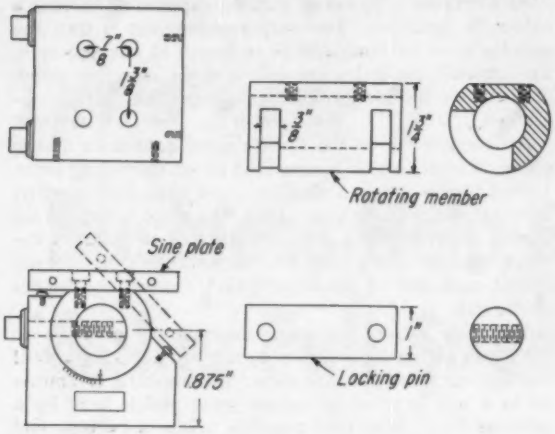


to the jaw-pivot pins. The OD should, of course, be concentric with the bore while the tapered nose end is provided with a ring groove to carry a spring coil. Three slits are then milled 120° apart along and half way down the body into the bore.

The jaws, being made of oil hardening tool steel, in a thickness to fit freely in the slits, are cut to the contours shown in the sketch. On this, and the placement of the pivot hole, depends largley the success of the chuck. The point to keep in mind is that the distance between the gripping lobe and the pivot must be shorter than that from the pivot to the angular resting surface a the back end of the jaw. It is against this surface that increased pressure will cause the jaw to grip tighter.

A G, Budapest, Hungary

Rotary Adjustment and Lock=Sturdier Sine Plate



If you're looking for faults with this tool, you could probably only say that it's higher than a regular sine plate. But this is greatly overshadowed by a few of its own features not found in standard sine plates, as for example: (1) It is rigid enough to hold a set angle under heavy machining. (2) It can be used with equal ease on a magnetic chuck or on the machine table as well as in a machine vise, should the need arise. (3) Work-holding plate angles can be changed while the base block is in fixed position on either machine.

Should the illustrated size work plate be used, angle accuracy can, with the aid of a sine bar, be as critically set as any sine plate. At other times, a bevel protractor, an indicator, or graduations on the end of the block will serve for less discriminating adjustments.

As the sketch shows, the work plate is only as big as the width and breadth of the base block (3 x 3 in.). These dimensions are, of course, optional as the block with its clamping system is sturdy enough to carry a plate much larger. The base stock and locking mechanism require uncomplicated but careful machining.

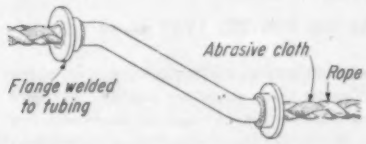
After selecting a steel block (CR steel will do) and squaring up all sides to 3 x 3 x 2½ in., make a smoothly finished 2.000-in. bore with a center distance of 1.875 in. from the bottom face and parallel with it. This means the bore will break through the top face, but there will still be more than enough stock left for measuring. Should you prefer a continuous cut, you can allow more stock on top and later cut it down to size. Once the bore is finished, machine a 45°-angled face along one side to within 1¼ in. of the bottom. The slot on each end is for strapping the block to the machine table.

Now turn and bore the rotating member on which the work plate will be affixed. The OD should have a snug fit in the block, and the ID is 1 in. to take a pin of that diameter for locking set angles. Next, mill two slots through the wall thickness and a land for the work plate as shown in the detail.

Before final grinding, which should be on the land and the top surface of the work plate after it's mounted, drill and tap holes as indicated. Two through holes go in the block for the locking screws and are spotted into the locking pin which later is drilled and tapped for 5/16-in. capscrews. Tapped holes for stop screws are located in the block—one on top face, locating the work plate horizontally, and on one the 45° face for the extreme tilt.

Work-plate mounting holes are drilled and tapped in the land of the rotating member, and counter bored clearance holes are drilled through the plate itself. Two edges of the plate are tapped 8-32 so side plates can be affixed.

Henry E Piltz, East Orange, NJ



Here's Another Rope Trick

Strips of abrasive cloth, interwoven between the strands of rope do a fine job of polishing the interior surface of pipe or tubing.

The strands are spread open by giving the rope a reverse twist and the abrasive strips are inserted, coated side out, in the openings. Releasing the rope closes the strands to hold the strips securely.

This was our solution to a recent finishing problem in which discoloration caused by welding had to be removed before the parts could be accepted. Prior to putting two bends in seamless SS steel tubing, to produce offsets for plastic tooling, the interior had been highly polished. A flange was then welded to each end of the tube with the result that the surface was slightly roughened by the heat.

Restoration of the acceptable finish was quick and simple with the abrasive-loaded rope. It was inserted through the tube and pulled forth and back until the inner surface literally glowed.

Gerald Millerwise, Sebewaing, Mich

Servicing Ball Bearings

After tracing several pre-mature ball-bearing failures to our method of cleaning, we gave this up as a bad practice. Oh, we didn't do anything unusual, in fact, what we did is standard procedure in most shops.

A bearing is first washed in kerosene or other solvent and then subjected to a high-pressure air jet of drying before it's refilled with new lubricant. There's nothing wrong with the washing, but the air blast rotates the balls at high speed between relatively dry races when you grip one race and let the other and the balls spin freely.

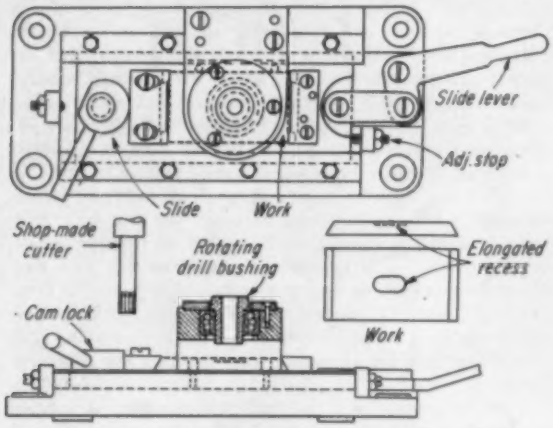
Minute particles, both metallic or abrasive, then do their dirty work best. Balls are scratched and scuffed, and you've started that bearing on its way to the junk box.

A better way is to force out the old grease with new, either by pressure or hand packing methods. This is also faster and, in a sense, cleaner.

S Clark, East Bradenton, Fla

Practical Ideas

Milling Fixture Doesn't Need Milling Machine



This fixture lets you do a simple but specialized milling job in a drillpress. What's more, you get the same accuracy expected only of a milling machine without any sacrifice in production volume.

The operation performed here is a simple one, but it serves only as a basis for other similarly common jobs which often "tie up" milling machines. In this case, an elongated recess is milled to precise length, width, and depth.

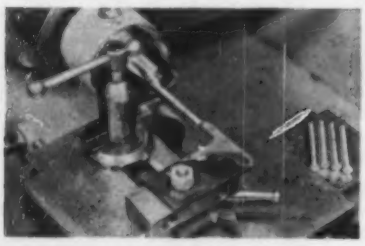
Being completely self-contained, the fixture can be used wherever a powered spindle, capable of holding a cutter, is available. The only requirement is that the spindle must be controllable to depth of cut and rpm. The bench-type drillpress with a ½-in. capacity chuck is therefore the ideal machine to make this fixture operative.

All components of the fixture are mounted on a base plate. A slide, which is operated by an extending lever linked to the slide, carries the work nest. This consists of a stationary plate and a clamping plate activated by a cam. Two locating pins are situated to position the work's back edge. And two adjustable stop screws, one at each end of the slide travel, control the length of the cut.

The only other stationary member, in addition to the gibs guiding the slide, is a standard carrying a drill bushing centered over the slide. This bushing is mounted in a ball bearing to reduce wear and is kept by a retainer ring. It is thus possible to use a regular end mill of the required size, but we prefer to make our own with cutting flutes on the end only and a blank shank to rest in the bushing.

To use, the cutter is first centered in the bushing. The depth stop is then adjusted so the cutter will only cut as deeply as required. After starting the machine, the cutter is gradually forced into the work as the slide is moved forth and back by the lever.

Hjalmar Dahl, Upplands Vasby, Sweden



Compound Stop Controls Stock Cut-Off Length

Parting off rod stock to close tolerances is made easy by attaching a stop to the compound of the lathe. The stock is merely fed through the spindle until it hits the stop, the collet is tightened and the parting tool plunge fed into the work. No other attention is required.

Because of the natural tendency of the collet to slightly retract the work in tightening, a solid stop, instead of one that swings out of the way, is a time saver.

The photo shows the simplicity of the setup. A steel plate, shaped to present a stop finger about 1 work diameter ahead of the cutting tool, is bolted to the compound in back of the toolpost. It is also raised by blocking so the finger is on or near the height of the work's center.

During application, the tool is, of course, withdrawn when stock is released, advanced, and rechucked. The stop is, by this action, placed in front of the work, but as the cutter moves forward, the stop vacates that position towards the back.

J C Magee, Schenectady, NY

Richard Prince Sioux City, Iowa Won $25 for his idea

AN EXTRA $25 will be paid for the best Practical Idea in each issue of *American Machinist/Metalworking Manufacturing*. Selection of the winning idea is made by a group of our readers.

PAYMENT—in addition to regular rate for item published—will be made as soon as tabulations are completed. The winner or winners—in case of a tie when duplicate prizes will be awarded—will also be announced in these pages.

JUDGES . . . are a group of *American Machinist/Metalworking Manufacturing* readers who select articles they prefer in a particular issue. This group changes entirely with each issue and represents a true cross-section of our readers. Their decision is accepted by the editors, without reservations or bias, as final in each case.

Reamer Assembly Aligns Itself

in the Feb 20, 1961 issue

REQUIREMENTS—All items appearing in the Practical Ideas pages are eligible. They must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with *American Machinist/Metalworking Manufacturing* standards. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co. Inc., and those of its advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: "Practical Ideas Editor" *American Machinist/Metalworking Manufacturing*, 330 West 42nd Street, New York 36, NY.

LET'S KEEP

Business Help For Our Colleges Going Full Speed Ahead

"Should our company fold up its program of financial help for higher education now that the Kennedy Administration plans to have the federal government provide this kind of help in a big way?" It is clear why, in the light of campaign promises and plans announced since, this question is being raised in many business firms at this juncture.

What seems far clearer, however, is the right answer to the question. It is a resounding NO! **This is no time for the business community to ease up in what have been its notably successful efforts to help our colleges and universities get out of the deep financial hole in which they are operating. On the contrary, this is the time to put more steam than ever behind the drive of business to increase its financial help for higher education.**

Massive Help Needed

It is easy to understand why any individual businessman or firm might have a rather despairing feeling about the prospect of competing with the federal government, with its almost all-embracing tax arm, in providing financial support for higher education or almost anything else for that matter. But this is not a case of competition. It is a case where our colleges and universities must have massive help all along the line if they are to be put squarely back on their feet financially—a goal of crucial and perhaps decisive national importance. **The business community will continue to have both the opportunity and the obligation to keep on increasing its help for higher education as rapidly as possible.**

To underline this proposition take a look at the chart at the top of the next page. It shows how far the salaries of college and university faculty members continue to lag behind those of other occupational groups in the U.S.A. There has been some relative improvement in the average of faculty salaries in recent years. And the salary improvement in some fields, such as those of science and mathematics, has been very pronounced. But the chart makes clear how badly the average salary of college and university faculty members still lags.

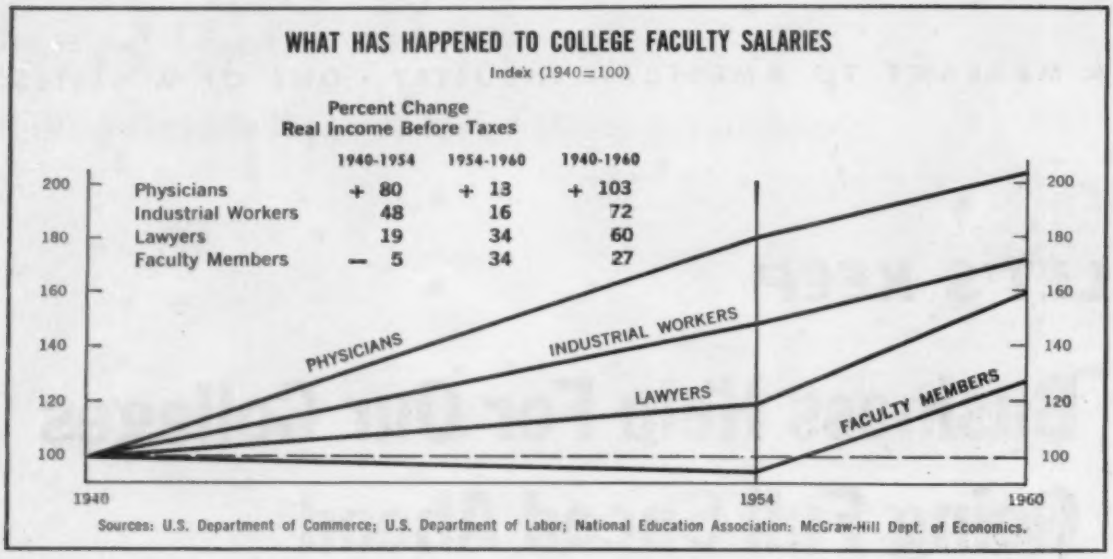
No Federal Funds For Salaries

The plans for increased financial aid for higher education, proposed by President Kennedy, do not contemplate increased expenditure for faculty salaries. This, we believe, is wise whether or not you feel, as many do, that resort to this kind of federal financing would inevitably carry with it federal controls that would ultimately undermine academic independence. The fight over federal appropriations for faculty salaries would be so long and bitter that it would be destructive to the aid program as a whole.

However, what the federal government will not be doing to remedy the deplorable condition of faculty salaries, as reported by the chart, is one indication of the tremendous scope that remains for crucially important help for higher education from business. Manifold other indications are available.

Disaster Escape Route

One of these indications is provided by the careful calculation that the annual income of our colleges and universities must be increased by about $4½ billion (from about $4½ billion to about $9 billion) over the next eight years if the tremendous wave of students



now gathering to descend on these institutions is not to wind up in both a financial and an educational disaster. This wave promises to add more than 2.5 million, or 75%, to college enrollments by 1970.

Thus far, the program for financial help for higher education by business, spearheaded by the Council for Financial Aid to Education, has been a remarkable success in all dimensions. The dollars contributed have increased rapidly—from about $100 million five years ago to about $150 million this year. Contributions of $500 million a year by 1970 are a clear possibility.

One of the inspiring developments increasing this possibility stems out of Cleveland, Ohio. There through their chief executives, an imposing group of business firms have established one per cent of their profits before taxes as their minimum goal for contributions to higher education, to be reached within three years. General acceptance of this goal by business would go most of the way toward getting our colleges and universities firmly on their feet financially.

Mutual Respect Increased

The mutual esteem of the academic community and the business community, an element of enormous importance to a free society, has been increased by the manner in which the program of financial aid has been carried out. In making its contribution, there has been no attempt whatsoever on the part of business to encroach upon the academic freedom of the institutions financially benefited. And the program of financial aid has greatly increased the knowledge, understanding and respect which the colleges and universities and business have for each other.

The Kennedy Administration's program to enlarge federal financial support of higher education is certain to arouse strenuous controversy. As proposed by its Task Force, it avoids some of the most controverial areas of principle. However, the very magnitude of the proposed extension of the federal government's already vast program of financing higher education involves fighting issues.

But if the enlargement of federal aid were to be deeply discouraging to the continued expansion of private aid for higher education, it would be a national misfortune of major proportions. There is no good reason why it should be. On the contrary, there is compelling reason for the business community to continue giving higher education all the financial help it possibly can, thus speeding onward a program that has been and continues to be a major constructive force for our colleges and universities, for business and for the nation.

This message was prepared by my staff associates as part of our company-wide effort to report on major new developments in American business and industry. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or part of the text.

Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY

Richard F Moore

is a shop man's shop man who gives unstintingly of his vast knowledge of tool and diemaking to shops across the country in an effort to better American industry and its products. From a two-man shop, he has built his firm into an internationally known maker of precision machine tools and tooling. No metalworking problem is too tough or too complex for this...

President in shirtsleeves

"Dick Moore is the kind of a guy who wrestles with a tough shop problem all day, then takes it home with him at night. But one thing you can bet on—he'll have the answer when he comes to work the next morning."

Up New England way, where they're not given to backslapping, these are words of high praise, coming as they do from a fellow Bridgeport industrialist.

Fact is, Moore is as tenacious as a bulldog when he gets his teeth into a shop problem—a stick-to-it-until-you-get-the-job-licked attitude he has inherited from his New England forebears.

Connecticut Yankee

For Richard F Moore, president of Moore Special Tool Co, Bridgeport, Conn, is the very prototype of the Connecticut Yankee, and like Mark Twain's celebrated adventurer in time, has more than his share of ingenuity and creativeness. This combination of traits has built a two-man tool and die shop into a machine tool company of international repute in just over a third of a century.

It has also given Moore a nationwide reputation as a trouble shooter. "Can't figure out how to do the job? Call Dick Moore." Such calls for help from manufacturers across the country have kept Moore hopping, and they have kept his special talents spread pretty thin over the years.

For he is a busy man in his own right, piloting a company that in its 36 years has produced Moore jig borers and jig grinders, die flippers, and Panto-Crush wheel dressers — along with a reputation as one of the top precision tool and die shops.

One of the founders of the National Tool & Die Manufacturers Association (in 1943), Moore served two terms as president (1944 to 1946), the only man to do so, and was the first recipient of NTDMA's L A Sommer Memorial Award "for outstanding service to the industry and the Association."

Moore Special Tool, which today employs around 280 people, had its beginning in 1924 when Moore, then 27 years old, set up shop on the second floor of a small building in Bridgeport. "Had one each of all the basic toolroom machines — and nothing much else," he recalls. Even then, Moore wasn't satisfied with the machines as they were, and with the aid of his helper took them all apart, reassembled and installed them.

Birth of a reputation

By April of 1924, Moore was ready for business. At year's end, the shop had acquired a staff of six and a local reputation for quality diemaking.

It was this same fetish for quality and accuracy that led to creation of the first Moore jig borer, which actually came into being in 1932 because the company needed a machine that would speed up its hole boring operations. Word soon got around among other precision tool and die manufacturers about this compact machine.

(Continued on next page)

In 1935, the first Moore jig borer went on the market. Less than a decade later, more than 600 of them had been sold. By this time, the company had moved to larger quarters. Success of the jig borer made still another move necessary in 1937, when Moore put 25 men to work in a leased plant, making nothing but jig borers, while another 35 workers were engaged in tool and die work at the main plant.

Then came another product of Dick Moore's restless creative urge, a jig grinder that could finish-grind straight and tapered holes to size in about a third the time formerly needed. This was a machine entirely new in concept.

World War II effort

Just before World War II, the company moved to its present location where, between Pearl Harbor and V-J Day, it shipped more than 700 jig borers and grinders, in addition to carrying out defense contracts.

The postwar years have seen several additions to the Moore tool family: the Panto-Crush wheel dresser (a combination roll-crusher and wheel-dresser that can be mounted on the wheel spindle of a surface grinder), bigger jig borers and jig grinders, and the die flipper—a device that virtually mechanizes die assembly, so that one man can do the work of three.

About four years ago, Moore came up with a universal measuring machine so accurate that it measures to 0.000,033 in., and which has found a ready market around the world wherever careful calibrations are needed, as in guidance systems for missiles and space craft.

Over the years, Moore has built up a twin reputation as a producer of quality machine tools and as a manufacturer of some of the world's finest and most complex tools and dies.

Unique public relations

At the same time, he has achieved industry-wide renown as a man who gives freely of his technical knowledge to metalworking manufacturers, and to other U S tool and die shops in an effort to instill quality and craftsmanship into the products of American industry.

"It is our most effective form of advertising," he says.

This willingness to share know-how and experience with others has led Moore into still another field, publishing. In this, as in almost everything he touches, Moore has been highly successful, too.

His first venture into technical publishing was in 1946, *"Precision Hole Location,"* or to give it its somewhat unwieldy full title, *"Precision Hole Location for Interchangeability in Toolmaking and Production."* Written by Moore's brother, Robert, this 448-page book not only became a "bible" on the subject, with sales running into the tens of thousands, but was named one of the "Fifty Books of the Year" in 1946.

A decade-or-so later, Moore brought the same subject up to date with a second book, *"Holes, Contours, and Surfaces,"* which he coauthored with his chief engineer, Frederick C Victory. It, too, has become a "bible" for metalworking.

Machine tool builder, master tool and diemaker, consultant, publisher—Dick Moore is all of these things, and more, too. But he is above all a shop man's shop man.

He is seldom to be found at his president's desk. Rather, he is likely to be poking his nose deep into the innards of a machine, or wading elbow deep in blueprints—always in shirtsleeves.

There is no air of bombast or self-importance about Moore. On the contrary, this spare, rather austere Yankee has a no-nonsense, let's-get-the-job-done attitude which he somehow seems to have instilled into his entire organization.

There are few titles at Moore Special Tool. "Up here in New England, we put our faith in men, not in titles," Moore says, "and we like our people to start at the bottom and really learn the business."

He practices what he preaches. Son Wayne, 29, is to be found in the shop, not in a plush office. Wayne, a one-time Olympic swimmer, became a journeyman tool and diemaker the hard way, completing a full five-year apprenticeship with no favors and no assists.

And Moore's 17-year-old son, Glenn, works in the shop half days during summer vacation. The oldest son, a navigator, was lost in action in World War II.

Two sons-in-law are in the business, too. Dwight Hansen, a Certified Public Accountant, is office manager, and John Drake rates a high word of praise from Moore, "He's a good shop man."

Izaak Walton, too

From this it can be seen that family life means much to Dick Moore, who is a grandfather ten times over. For relaxation, he likes nothing better than to grab up his two sons and two sons-in-law and hustle them up to Canada once a year for some fishing. "No women," he grins.

It can well be imagined that the many-faceted Moore is a busy man, but he is a warm and friendly man, too—once his New England reserve has been penetrated. And metalworking men will tell you the way to do that is to ask for his help on a knotty shop problem. •

Names in the News

Micromatic Hone Corp, Detroit, has appointed **Joseph L Pulliam** (left) to the newly created post of sales manager of the Micro-Precision Division at Los Angeles. **Thomas J Chadwell,** assistant to the director of marketing, succeeds Mr Pulliam as sales manager of the company's Microhoning products

American Motors (Canada) Ltd has elected **Earl K Brownridge** president. Formerly executive vice president and general manager, he succeeds **Roy D Chapin Jr** who has been named board chairman.

Sidney Machine Tool Co, Sidney, Ohio, has named **E W Wagner** vice president and general manager. Mr Wagner was formerly general sales manager

Ford Motor Co has elected **John Dykstra** (left) president of the company to succeed **Robert S McNamara** who resigned on Jan 3 to become Secretary of Defense. Mr Dykstra joined Ford as a manufacturing executive in 1947 and was elected a vice president in 1950. **Peter H Ponta** (right) will take over Mr Dykstra's former duties and will have the title of director of manufacturing staff. He was formerly director of the company's manufacturing and development office

R K LeBlond Machine Tool Co, Cincinnati, has named **Vincent W Stehlin** purchasing agent. Formerly assistant purchasing agent, he succeeds **William McKinley Reis** who has retired after 44 years with the company.

Thor Power Tool Co, Aurora, Ill, has appointed **Milton E Slater** executive assistant to the president. He was formerly manager of the Thor Farm and Ranch sales Division.

Warner Electric Brake & Clutch Co, Beloit, Wis, has named **Leland W Ruffner** manager, engineering and research. He was formerly industrial engineering supervisor at Stewart-Warner Corp.

Yale & Towne Manufacturing Co, Philadelphia, has appointed **Kenneth W Ashman** production and materials control manager of Yale Materials Handling Division. He was formerly associated with the General Electric Insulator Department in Baltimore as manager of materials. **Frank J Schultz** has been promoted from superintendent of assembly at the Philadelphia plant to general superintendent there.

Crane Co, Chicago, has elected **Norman B Champ Jr** a vice president of the firm. He was formerly vice president of Midwest Piping Co, St Louis, Mo, firm recently acquired by Crane.

Boston Gear Works Division of the Murray Co of Texas Inc has promoted **Edward F Cannon** from general superintendent of the Quincy (Mass) plant to works manager. **Alec D Shaw** replaces Mr Cannon.

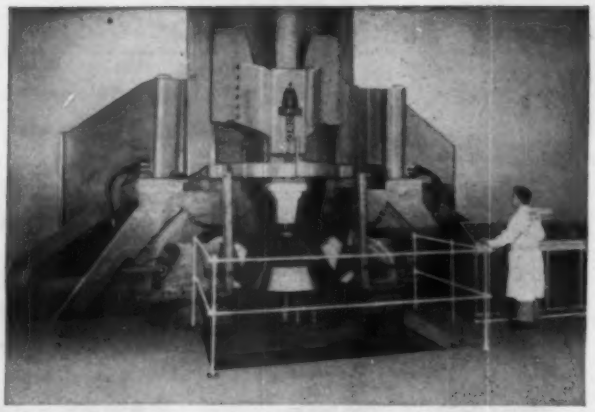
Toledo Scale Corp has named **Robert E Bell** vice president, engineering, of the Toledo Scale Division. He was previously chief engineer. **Frank Instone** has been promoted from general sales manager to vice president, sales, of the division. **Robert O Bradley,** chief engineer of the Haughton Elevator Division, has been made vice president, engineering, there.

Rockwell Manufacturing Co, Pittsburgh, has named **John H Diehl** assistant vice president, manufacturing, of the Power Tool Division. He was formerly general manager of the company's Bellefontaine, Ohio, power tool plant

(Continued on page 144)

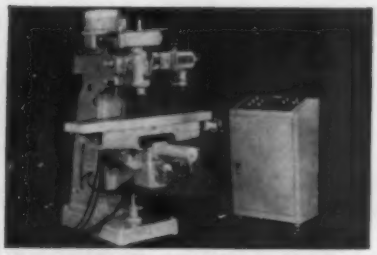
Taft-Peirce Manufacturing Co, Woonsocket, RI, has appointed **Kenneth H Williamson** (left) vice president, manufacturing. **Franklin Meyer Jr** (center) has been named vice president, engineering, and **John G Zeiger** vice president in charge of marketing. **Dr Walter M Saunders Jr** has been appointed metallurgical director

ACCEPTED ACCURATE AUTOMATIC



Hufford Corporation spin forge machine with *two* Honeywell 360° Tracer Control Systems plus spindle speed control.

HONEYWELL ELECTRO HYDRAULIC TRACER SYSTEMS



Gorton Vertical Milling Machine equipped with Honeywell 360° Electro Hydraulic Tracer Control System.

Frauenthal vertical contour (radome) grinder with Honeywell Electro Hydraulic Tracer Control System.

Giddings & Lewis Vertical Mill with two Honeywell 360° Electro-Hydraulic Tracer Control Systems.

Now operating on a wide variety of well-known machine tools (some of them illustrated at the left), Honeywell 180° and 360° Tracer Control systems provide fast, accurate and reliable system response for smooth application of large increments of hydraulic power.

They combine the flexibility, remote control and finesse of electronics with the power and fast actuation of hydraulics. They're far more flexible than completely hydraulic systems. These systems have been designed for ease of application. Modular construction simplifies and speeds field service.

ACCURACY—Accuracies of + .0005″ from template to part and + .0002″ from part to part have been achieved in actual use.

ADAPTABILITY—These systems are now in operation on all types of machine tools, from light duty engine lathes to huge spin forging machines. Every application is custom fitted—at production line prices.

PERFORMANCE—Each Honeywell system becomes an integral part of the machine tool. The control system can be adjusted to compensate for changes in machine performance during the life of the machine. Speed range of 300 to 1 is normal; greater rangeability is available on some applications. Tracing speed ranges up to 60″ per minute are available.

For further information on Honeywell's new machine control systems and components and their application to your specific job, contact Minneapolis-Honeywell, Machine Control Group, Dept. AM-5-61 Minneapolis 8, Minnesota. *Sales and service offices in all principal cities of the world.*

Honeywell

H First in Control

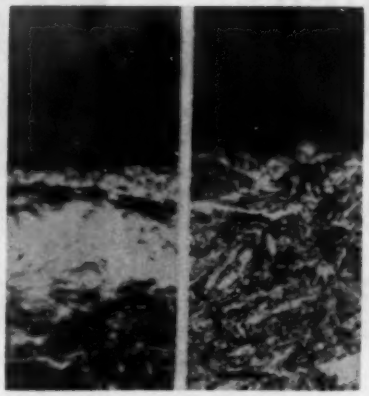
Heat Treating Process Takes White Layer From Nitrided Steel, Adds to Case Depth

Ban-Wite heat-treating process removes the white layer from nitrided steel parts such as aircraft production gears, master gears, and bearings without grinding or removing metal from the parts. The nitrided steel parts are first coated with an impervious heat-resistant material and heated under controlled conditions. After heating, and upon removal of the coating, the nitrided parts are free of the white layer.

In addition to ridding steels such as Nitralloy 135, SAE 4140, and SAE 4340 of the white layer, the Ban-Wite process reportedly increases the case depth of these steels.

National Broach & Machine Co, 5600 St Jean Ave, Detroit 13, Mich

MORE DATA? Circle 51, inside back cover



Microphotograph of nitrided steel (left) shows white layer, which is removed by Ban-Wite process (right)

Permanent Cyanide Brightener Is Freely Soluble in Water

Kenvert No. 15-Br, a concentrated, permanent-type brightener for cyanide zinc plating solutions, is a liquid, freely soluble in water and in the zinc plating solution. It is said to exhibit excellent stability against breaking down in zinc solution operated at higher than normal working temperatures.

Because the brightener gives a full, bright range from high to low current density areas, it is satisfactory for use in either rack or barrel plating baths. Furthermore, additions do not have to be made on a frequent basis; additions on a shift or daily basis are adequate.

Conversion Chemical Corp, Rockville, Conn

MORE DATA? Circle 52, inside back cover

Hardalloy Electrode Both Joins Dissimilar Metals, Gives Buildup

Hardalloy 120 is a new hard surfacing electrode that joins such dissimilar metals and hard-to-weld steels as austenitic manganese to carbon steel, austenitic manganese to T-1 steel, and stainless steels to carbon steel. It has a controlled ferrite level of approximately 12%; this provides crack resistance equal to armor welding electrodes.

The new electrode is also said to be an excellent buildup material because of its high compressive strength and its ability to withstand repeated impacts with minimum deformation and no cracking. It has good corrosion resistance and hot hardness up to 1000 F.

The Hardalloy 120, which is an all-position electrode that can operate on either ac or dc current, is supplied in 1/8, 5/32, 3/16, and 1/4-in. sizes in standard 14-in. lengths. Each pound of electrode covers from 24 to 27 in., ⅛-in. thick.

McKay Co, 1005 Liberty Ave., Pittsburgh 22, Pa

MORE DATA? Circle 53, inside back cover

Stainless Foil Is Self Adhesive

Self adhesive stainless steel foil bonds to most smooth, clean, dry surfaces with an initial adhesion of 2 to 4 lbs per in. Bond strength builds up 60 to 75% in the first three days. The 0.003 in. stainless foil will remain adhesive for two years on the shelf and will stick to surfaces throughout a temperature range of –50 to 300 F.

Fasson Products, 250 Chester St, Painsville, Ohio

MORE DATA? Circle 54, inside back cover

Kaiser Aluminum Announces Exterior Automotive Trim

Aspecially designed new aluminum alloy, registered as 5252, is said to have substantially improved strength and to be ideally suited for body side molding and other automotive applications where superior resistance is a primary consideration. In addition to strength, the alloy claims good ductility and an anodized appearance comparable to other alloys used for bright trim parts.

The company reports ultimate strengths of 35,000 to 45,000 psi and yield strengths of 30,000 to 40,000 psi in optimum ductility range.

Kaiser Aluminum & Chemical Corp, 300 Lakeside Dr, Oakland 12, Calif

MORE DATA? Circle 55, inside back cover

Graphite Lubricant Forms Tough Coat That Prevents Corrosion

Slip-plate lubricant is brushed, rolled or sprayed on surfaces and will air dry in 10 to 15 minutes to form a hard bonded graphite coating. The coating is not affected by temperature changes from –75 F to 800 F, is a good conductor of electricity and heat, and will not collect dirt or dust. In addition to producing a lubricating film that is said to outlast others by 10 to 1, it serves as a rust preventitive.

The lubricant comes in light and heavy consistencies. No 1, heavy coating leaves a film 7 mills thick; No 2, light coating leaves an average film 4 mills thick.

Superior Graphite Co, 33 South Clark St, Chicago 3, Ill

MORE DATA? Circle 56, inside back cover

Chemical Dip Descales, Polishes Stainless Without Electricity

DS-9 Bright Dip process polishes and descales stainless steels of the AISI-300 series with a simple chemical immersion that does not affect silver and brass solder. The process is said to produce a uniform specular finish on stainless without use of electric current and with min metal loss.

Tests on panels of 302 stainless with a 2B finish showed a maximum loss of 0.5 mills per side after brightening with DS-9.

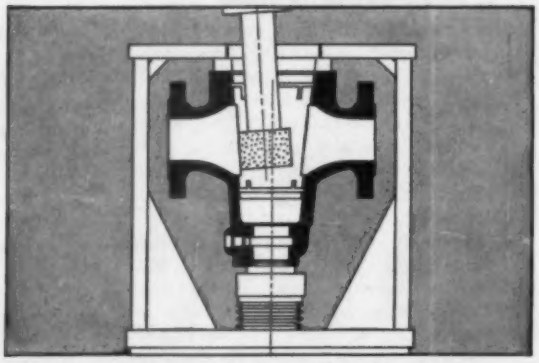
Diversey Corp, 1820 W Roscoe St, Chicago 13, Ill

MORE DATA? Circle 57, inside back cover

Vertical grinding tapers profitably

Standard vertical grinder above is typical of those used by leading manufacturers of large valves for grinding internal taper seats. Profits are made because set up time is fast; for example, it takes about five minutes to change over from grinding 18″ valves to 10″ valves. The inherent rigidity of the machine is made doubly effective by gravity. Valve, fixture, and face plate are supported on a heavy *vertical* work spindle which promotes accuracy, precise concentricity, and extremely fine micro-inch finish.

SPRINGFIELD



Internal valve tapers, as shown above, are fast payoff jobs on a Springfield Vertical Universal Grinder. On this valve taper, stock removal is 0.020″ with a requirement for 85% blue or better on a taper gage. Surface finish is held well within the 30 RMS specified. Machine swings to 52″, grinding holes from 2″ to 42″ dia., 24″ deep in irregular or regular shaped work pieces.

Not limited to internal or exterior tapers, a Springfield grinds efficiently on O.D. and I.D. shoulders, offsets, undercuts, irregular holes, and mating angles—usually in one chucking.

A few production and toolroom men turn to a Springfield because there's no other way to do the job. Most turn to a Springfield because it's the most profitable way to do many jobs. Write today for Bulletin No. 197-D. The Springfield Machine Tool Company, Springfield, O.

Westinghouse Announces Copper Laminate for Printed Circuits

Micarta Grade 65M24—a new copper-clad epoxy resin/paper base laminate—is said to withstand a wider range of humidity than do superior grades of phenolic resin/paper base laminates and to be less expensive than NEMA G-10 and G-11 glass base/epoxy resin laminates. It is designed for printed circuit and other electronic applications requiring high strength and consistent electrical properties over a wide range of humidity levels.

The material is to have good punchability at room temperature and to be superior to standard cold punch phenolic-paper based laminates in flexural strength (24,000 psi with the grain), bond strength (9 lb average) and solder resistance (20 sec to solder at 500 F). It is classed as a nonburning material.

Electrical properties include: a dissipation factor of 0.034 at one mc; dielectric constant of 4.5 at one mc (after 24 hr immersion in water at 50 C); insulation resistance of 100,000 megohm; volume resistivity of 1,000,000 megohm-cm; and surface resistance of 1000 megohm (after 96 hr conditioning at 34 C and 90% relative humidity).

The material is available in sheets 36 x 36 in. or 36 x 72 in., and thicknesses ranging from 1/32 to ¼ in.

Micarta Div, Westinghouse Electric Corp, Hampton, SC

MORE DATA? Circle 58, inside back cover

Aluminum-Silicon-Copper Alloy Is Non-Magnetic, Light Weight

Aluminum - silicon - copper alloy known as Ampcoloy is non-magnetic, will hot forge and is free machining. The corrosion resistant metal is available in two extruded shapes, solid round and hexagon, and is intended for valve stems, valve seats, gears and marine hardware.

Designed for high - production screw machine work, the alloy will withstand relatively high temperatures. Manufacturer will supply mechanical and physical properties, specifications.

Ampco Metal, Inc, Milwaukee, Wisc

MORE DATA? Circle 59, inside back cover

Aerosol Belt Dressing Contains No Asphalt, Resin; Won't Glaze

Sprayon No. 607 belt dressing, which is packed in 16-oz aerosol cans, is said to give power increases of up to 50% on belt drives. It is a new formula that contains neither asphalt nor resin, and will not glaze.

The lubricant, which will not collect dirt or dust, is said to actually clean belts of accumulations, and to be ideally suited for wet, outdoor conditions.

The new belt spray is intended for leather, rubber, canvas, and other fabric belts in flat, round, or V-styles.

Industrial Supply Div, Sprayon Products, Inc, 2075 E 65th St, Cleveland 3, Ohio

MORE DATA? Circle 60, inside back cover

High Temperature Ceramic Adhesive Bonds up to 2600 F

Melbond CA-100 is a new ceramic adhesive, for use with refractory materials such as ceramics; it possesses a maximum service temp of 2600 F after being cured at only 250 F. The adhesive has low dielectric constant and loss tangent, attains a high degree of mechanical strength, and will not flake or disintegrate during use.

Because it has a paste-like consistency, Melbond can also be used for coating items requiring high temperature protection. It adheres well to Melfoam dense alumina, Pyrophyllite, K-30 brick, Foamsil, and graphite up to 2000 F; to dense Zirconia up to 1500 F; and to Alundum Firebrick, cast MgO, brick, and cinder block to 1000 F.

Mixing and application of the adhesive is done by stirring it thoroughly with a spatula or stirring rod. When used as an adhesive, a thin coating is applied to both surfaces to be united, whereupon the pieces are joined under light pressure to assure complete and even contact.

Special Products Div, Melpar, Inc, 3000 Arlington Blvd, Falls Church, Va

MORE DATA? Circle 61, inside back cover

Silicone-Epoxy Potting, Sealing, Molding Compounds Cure Easily, Resist High Heat

New family of epoxy-silicone rubbers known as Eccosil includes a potting compound, a foam rubber, an impregnant and potting compound, and a general-purpose silicone rubber. Both potting compounds, Eccosil 4712, and Eccosil 4520, will withstand prolonged heat aging at temperatures up to 450 F. Tensile strength of these two compounds is 1,000 and both are said to bond readily to many materials without priming.

Eccosil 4850 general purpose RTV silicone rubber is a pourable resin that will cure at room temperature to a heat-resistant rubber for potting, caulking and making flexible molds. Temperature capability is up to 600 F and tensile strength is 800. This compound will cure and bond to itself without primer, but for adhesion to plastics, metals and other materials, Eccosil Primer 33 is recommended.

Eccosil 4640 produces a unicellular foam, said to be half the weight of conventional RTV rubber, after cure at room temperatures. Designed for potting, caulking and sealing in aircraft or other applications where light weight is necessary, it will withstand temperatures up to 600 F. Dielectric constant and loss are reportedly much lower than for other silicones so that the material can be used for dip-coating vacuum tubes to cushion them. As with 4850, 4640 will bond to itself without primer and uses Eccosil Primer 33 for bonding to other materials.

Emerson & Cuming, Inc, Canton, Mass •

MORE DATA? Circle 62, inside back cover

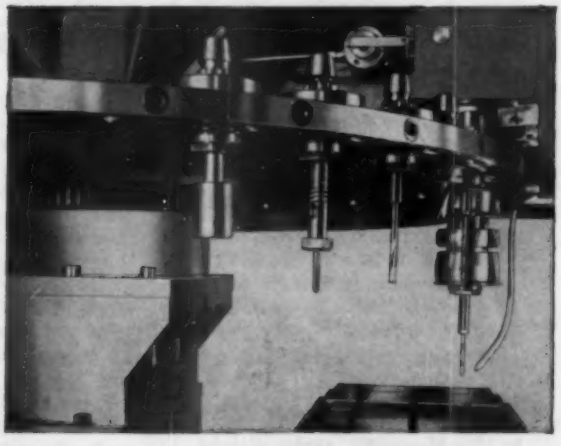
TOOL CHANGES IN SECONDS
BY NUMERICAL CONTROL

CLEEREMAN
SPINDLEMASTER

DRILLS, TAPS, BORES, REAMS, MILLS

Mechanical Tool Changing Controlled Completely by TAPE COMMAND

- Select any one of 30 tools.
- Position all three axes.
- Control speeds and feeds.
- Activate coolant cycle.
- Control type of operation.



The Cleereman Spindlemaster was designed from the start for Numerical Control and the Control was especially designed for this machine. It is the latest development in versatility in automatic operation on precision work.

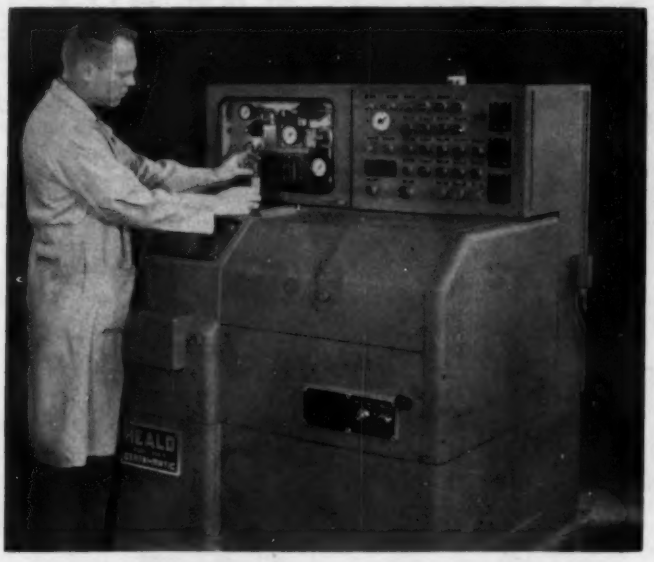
Look into this new, cost-cutting opportunity by requesting full details.

CONTACT YOUR NEARBY CLEEREMAN DISTRIBUTOR OR PHONE, WIRE OR WRITE

CLEEREMAN MACHINE TOOL CORP.

GENERAL DISTRIBUTORS: The Jackson-Fotsch Company • 7356 West Lawrence Avenue • Chicago 31, Illinois

Factory: Green Bay, Wis.



Heald Miniature Grinder Finishes 1000 Parts/Wheel, Repeats to 0.000,01 in.

The model 090A, a new precision miniature internal grinder has 75% less hydraulic and electrical control equipment and a cabinet that is 1/3 smaller than older models.

Wheel life on the 090A has been increased to around 1,000 pieces per wheel by making the incremental wheel compensation infinite in a range from 0 to 0.001 in. Older models had a random reliability from 0.001 to 0.001. In addition, repeatability within 0.00001 in. has been achieved on the new model by constructing a vibration-damped feeding cross-slide that rides on antifriction ways. This cross-slide saves time on wheel changes by automatically resetting to new wheel position.

Changeover time has also been reduced on the new machine with installation of direct reading micrometer-type dials on all major adjustments. This allows all cross-slide positions to be set from data sheets without using a dial indicator setup.

A direct reading digital dial which shows the amount of wheel life remaining allows an operator to anticipate wheel changes, and a new automatic cycle that swivels both the wheelhead and workhead reportedly improves accuracy.

Other new features of the machine are, complete accessability through rear door panels for service inspection, enclosed work area, and end-to-end placement of several machines made possible by eliminating the necessity for access from the ends.

The Heald Machine Co, Worcester 6, Mass

MORE DATA? Circle 63, inside back cover

Light Wave Micrometer Measures To Ten Millionths With Vernier

Model LWM-60 light wave micrometer reads directly on the handwheel to 0.00010 in. and on its vernier to 0.000,01 in. (ten millionths). The unit, which has a capacity of 0 to 2 in., requires no gage blocks and need not be used as a comparator.

Designed as an inspection standard, the instrument instantly measures basic standards, plug gages, measuring wires, and setting blocks. It also checks roundness of cylindrical shapes and measures pitch diameter of threads and gears.

Handbook 77, National Bureau of Standards, says that the instrument "incorporates the accuracy of a light wave pressure indicator and provides the highest accuracy of screw micrometers."

The Van Keuren Co, Watertown, Mass

MORE DATA? Circle 64, inside back cover

Reed Three-Die Thread Roller Operates at 60 Pieces a Min

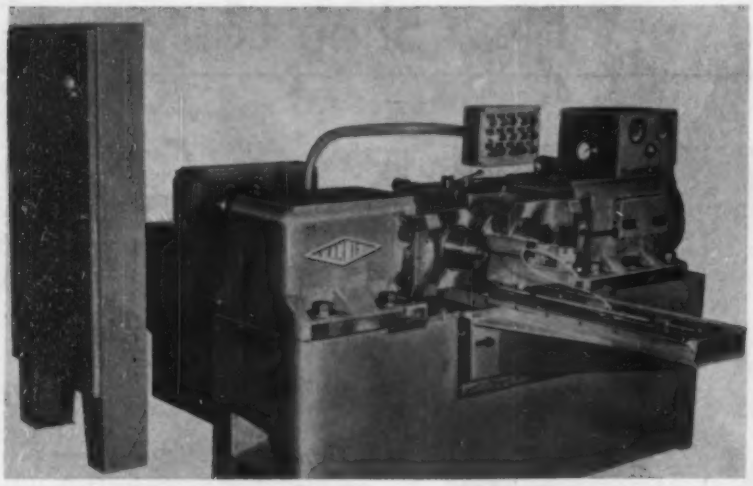
The Model A22 three cylindrical die thread and form rolling machine can now be obtained with a new high-speed oscillating head that gives production rates as high as 60 pieces per minute. This is approximately 50 to 100% higher than previous automatic setups with the A22.

The higher production rates are possible because the use of aluminum in the cam-actuated oscillating head reduces the weight of the complete head assembly about 40%. A new cam contour has been developed for smooth operation of the head at the higher rates of 50 to 60 cpm.

The Model A22 machine is available with the new high-speed head at no change in price. In addition, high-speed work handling equipment for many types of parts is available for operation at these higher rates.

Reed Rolled Thread Die Co, 791 Main St, Holden, Mass

MORE DATA? Circle 65, inside back cover



Landis Machine's Thread Roller Delivers 200,000-lb Force Over 6-in. Dia Range

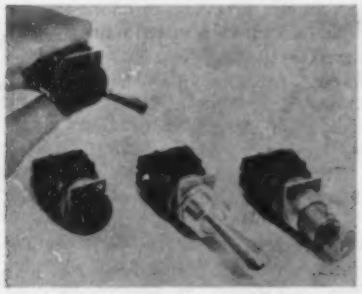
This new Hy-Duty (see *AM/MM*—Apr 17 '61, p 124) thread rolling and forming machine — designed for thread, form, spline, and gear rolling applications which require rolling forces of up to 200,000 lb—has normal diametrical capacity from 0 to 6-in. max for infeed rolling and from 0 to 4-in. diameter for thrufeed rolling. Thread lengths of 11½ in. are obtainable for infeed, up to 20 ft for thrufeed.

To withstand the machine's high rolling force capacity, the spindles are of 4½-in. dia heat treated alloy steel. Bearings range up to 12 in. dia and 12-in. length. However, where the work to be rolled does not demand such heavy duty equipment, replaceable spindle units with 3-in. dia spindles can be furnished. These allow smaller, less expensive dies.

The power transmission is powered by a 50/25-hp, 1800/900 rpm motor through speed change gears. Six standard speeds are available from 78 to 476 rpm for the 50-hp range, and from 39 to 233 for the 25-hp range. The worm gear transmission and speed change gear box are rated as 90% efficient at maximum speed.

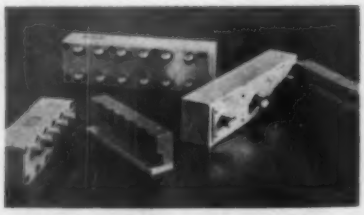
The Landis Machine Co, Waynesboro, Pa

MORE DATA Circle 66, inside back cover



FOUR MINIATURE PUSHBUTTONS, added to line, include (l to r): bat lever selection switch; coin-operated selector switch; wobble stick operator; and cylinder lock selector switch. In addition, separable operators, contact blocks, rings, selector switch knobs, illuminated forms, and color caps are available—*General Electric Co, Schenectady 5, NY*

MORE DATA? Circle 67, inside back cover



Hydraulic Vise Jaws Facilitate Accurate Clamping or Machining

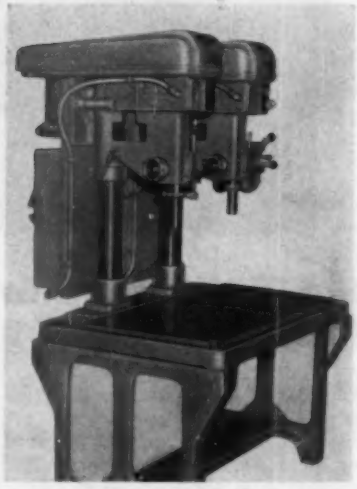
The Hydrajaw, a completely self-contained unit made in sizes from 4 in. up, firmly holds irregularly shaped objects such as tapered rods, angle irons, and other difficult-to-clamp pieces. It will also hold simultaneously a series of round-section workpieces in various positions.

The main body of the Hydrajaw has a series of protruding plungers which are interconnected internally by a hydraulic fluid. By tightening the vise handle, the body moves forward until one or more of the plungers make contact with the work piece. Continued tightening forces contacting plungers into the body, thereby transmitting energy to the remaining plungers, which are forced out until they also make contact with the workpiece.

This enables the device, which is made in England, to grip an uneven surface, with each plunger exerting an equal pressure. The workpiece can be left clamped for an indefinite period without loss of pressure.

Dist by Smith, Bell, & Co, Inc, 160 Broadway, New York 38, NY

MORE DATA? Circle 68, inside back cover



Buffalo No. 20 Drill Offered in Floor, Bench, or Pedestal Mount

No. 20 Drilling machine has a capacity of 1 in. in mild steel. Available in floor drill, standard bench drill with tilting table, production bench drill or pedestal drills with one to six spindles, the machine features a full 6 in. spindle travel for sensitive hand feed or power feed.

The spindle return spring can be adjusted by hand without tools and the depth stop bar is equipped with an adjustable collar.

Locking device to clamp frame on column is split bushing type. Five step pulleys are geometrically progressed so that belt changing can be done without adjusting motor.

Options include power feed, variable speed drive, and head raising device. A table raising device and production oil trough table are available for bench and floor models.

Buffalo Forge Co, 490 Broadway. Buffalo 5, NY

MORE DATA? Circle 69, inside back cover

You get more value for the same dollar— in the NEW Bulletin 709 line of starters!

Note the compactness of both the smallest and largest starter in the new Bulletin 709 line. Ratings up to 100 hp, 220 v; 200 hp, 440-550 v.

This new line of Allen-Bradley motor control will change every idea you have had about starter size, performance, and life. The small size—especially in the higher ratings—is startling. Yet rating for rating the operating life and reliability have been increased many times. Built into each of the seven sizes of this new Allen-Bradley line is an ability to interrupt tremendous currents and to operate year in and year out for many millions of operations without trouble or maintenance.

The new Bulletin 709 starters are just as advanced in appearance as they are in performance. All seven sizes have an aristocratic styling and a distinctive family likeness. Brooks Stevens, famous industrial designer, has given the enclosures such an attractive, modern style that these new starters will prove a distinct sales asset on any machine or installation.

Why not write today for more information on this revolutionary new line of Allen-Bradley Bulletin 709 *quality* across-the-line motor starters?

10-61-RM

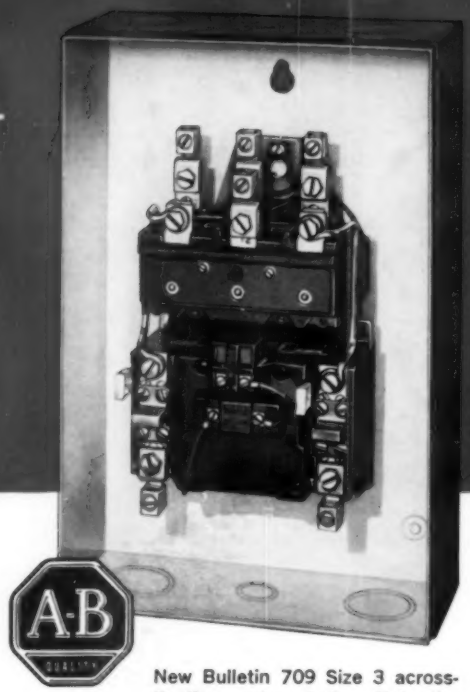
ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

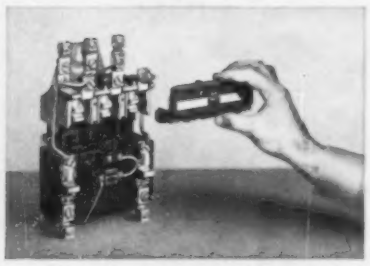
QUALITY MOTOR CONTROL

Features of the NEW Allen-Bradley starter line that are of value to you!

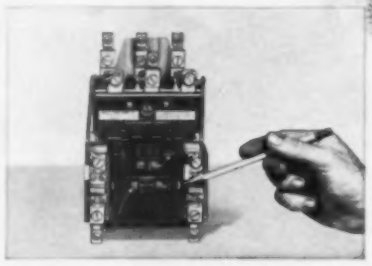


New Bulletin 709 Size 3 across-the-line motor starter. Note the generous space for wiring, accessible terminals, and white interior.

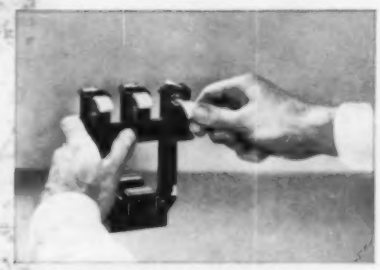
Every detail of the new Allen-Bradley motor starters has been designed to help make this the best line of motor control on the market. Remarkably small in size, each starter is a giant in performance. Being light in weight, these starters are easy to handle and a cinch to install. The generous wiring space, full front wiring, white interiors, and convenient knockouts make installation easy. The enclosure cover is firmly held with a quarter-turn fastener. All installation, inspection, and maintenance operations can be handled from the front—as shown in the illustrations below—without the use of special tools.



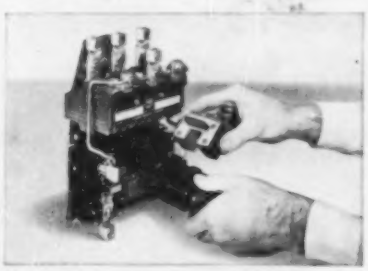
QUICK, EASY CONTACT INSPECTION—When the arc hood front cover is removed by loosening two captive screws, contacts are plainly visible from the front.



CONTACT POSITION INDICATED—Two slots in the coil cover show the position of the movable contact support—tell whether contacts are "closed" or "open."



CONTACTS EASILY REPLACED—Depress the spring slightly, and the movable contacts can be lifted out of the molded support and the new contacts slipped in.



COIL EASILY CHANGED—When the coil cover is removed, coil and magnet yoke can be lifted out from the front. They are impossible to replace incorrectly.

AUXILIARY CONTACTS EASILY ADDED to the front of the starter. Two extra auxiliaries can be added to Sizes 0, 1, and 2 starters, and four, to Sizes 3, 4, and 5.

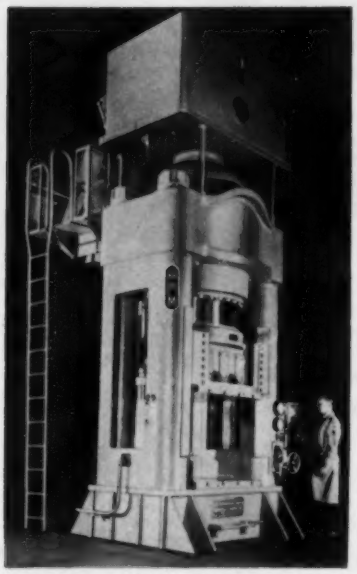
A THIRD OVERLOAD RELAY CAN BE EASILY ADDED in the field, from the front of the starter. And the only tool needed is a common screwdriver.

ALLEN-BRADLEY

Member of NEMA

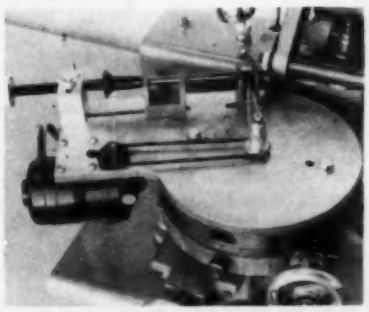
Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

QUALITY MOTOR CONTROL



1500-TON HYDRAULIC FASTRAVERSE PRESS can be changed from semi-automatic to manual operation without stopping. Pressing area of the giant is 48 x 48 in., stroke is 36 in. and daylight between bolsters is 48 in. Closed circuit operating system is powered by a 50 hp electric motor—*H-P-M Div, Koehring Co, Mount Gilead, Ohio*

MORE DATA? Circle 70, inside back cover



Universal Grinder Has V-Blocks For Grinding Laps And Stems

The Model U-800-A Unitest grinder equipped with V-block fixtures will grind laps or stems from ⅛ to ⅝ in. dia and from ⅝ to 9 in. long. With cast iron, stainless steel, or stone lapping arbors turning at 10,000 rpm, the machine will grind angles from absolute parallel to 160 deg.

Rotation of the cast iron table is done with a vernier handwheel graduated in 3-min increments, and smooth traverse of the table is aided by a flywheel-type traverse handwheel.

Marine Pumps, Inc, Div of Diesel Control Corp., Wilmington, Calif

MORE DATA? Circle 71, inside back cover

Bullard's M-Type Mult-Au-Matic Can Have 6 to 12 Spindles, Maximum 60-hp Motor

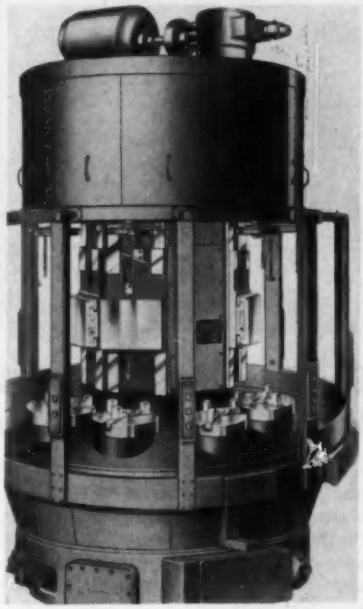
The new type M series of Multi-Au-Matics, said to be low-cost general purpose machines, are available in six, eight, or twelve spindle sizes. They are powered by an 1800 rpm, 60-hp (maximum) motor; the horsepower of the motor will depend upon the job for which the machine is selected.

One of the features of this machine is its space-saving characteristics. It is only 90 in. in diameter, and stands 142⅜ in. from the floor. The weight varies between 25,500 and 34,000 lb, depending upon the number of spindles selected.

Spindles are mounted on three precision anti-friction bearings to insure proper alignment at all times. This also allows speeds to 400 rpm on six and eight-spindle machines, and 750 rpm on 12-spindle machines. A conically-shaped chip and coolant guard encloses the spindles and prevents chips from piling up behind work spindles.

By using change gears, a wide number of independent spindle speeds can be obtained at each work station; also, feed rates can be varied at each station to suit machining requirements.

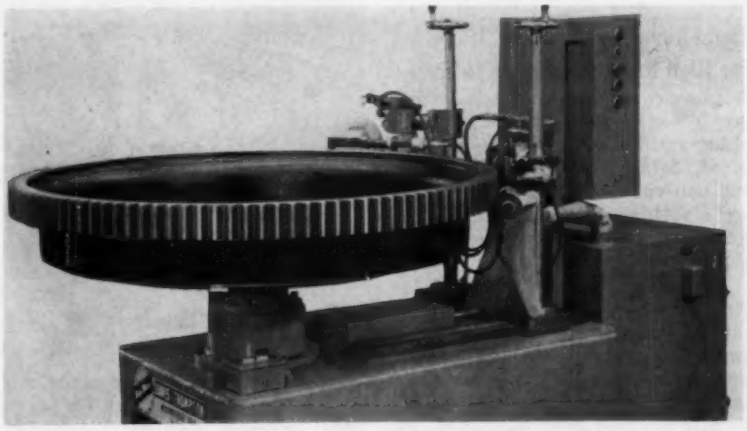
Some of the many standard and auxiliary heads available are: plain vertical head with eight-inch vertical movement only; plain compound head with single tool that has a total stroke of eight in. vertical and a max



of four-in. horizontal slide movement in either direction; standard universal head that may be swiveled to 90° either way of work axis; standard double purpose head that has eight-in. stroke with max three-in. slide movement and horizontal slide movement in 1:1, 4:3, 2:1, and 3:1 ratios.

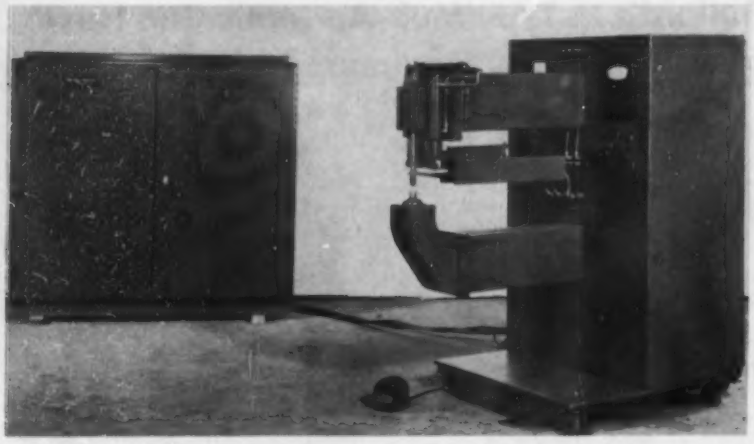
The Bullard Co, Bridgeport 9, Conn

MORE DATA? Circle 72, inside back cover



MODEL DB-60 GEAR DEBURRER uses double arms to simultaneously deburr both sides of gear teeth. Capacity is from 8 to 60-in. dia, and up to 28 in. face. A ½ hp variable speed drive rotates the work; electronic control has a ratio of 25:1; settings can be preselected—*Davis and Thompson Co, 4460 N 124th St, Milwaukee 18, Wis*

MORE DATA? Circle 73, inside back cover



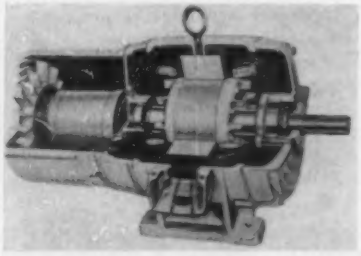
Sonobond 4000-Watt Ultrasonic Spot-Type Welder Features Throat Depth of 36 in.

This 4,000 watt ultrasonic welder, designated model W-4000-FSR, has a separate power source that can be remotely located from the welder and connected to it by two small power cables. Throat depth of this model is 36 in.

The new welder also has a water cooled ultrasonic coupling system that reportedly permits higher welding repetition rates at higher powers than was previously possible.

Sonobond Corp., Subs of Aeroprojects Inc, 310 E Rosedale Ave, West Chester, Pa

MORE DATA? Circle 74, inside back cover



Rapid Reversing Motors Offered For High Production Applications

Motors are available in a complete line of integral horsepower, polyphase ratings offered in open drip-proof, totally enclosed fan-cooled, and non-ventilated enclosures. These are also furnished in blower-cooled constructions that incorporate an integrally mounted blower.

They are primarily designed for high production machine tool applications, offering up to 125 idle reversals per minute in the smaller sizes with open type construction and can be built to exceed 200 idle reversals per min with blower cooled designs.

Features include Class A insulation with special Class B and H available for special high reversing capacity motors; multi-speed designs for slow infeed speeds along with faster withdrawal speeds as in the case of drilling and tapping machines; and rolled shell shaftless designs for compact direct built-in drives.

Louis Allis Co, 427 E Stewart St, Milwaukee 1, Wis

MORE DATA? Circle 75, inside back cover

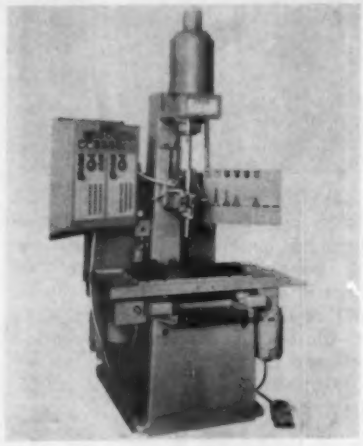
Stock Indicator Housings Offered in Two Sizes

Use of these standard housings can reportedly save as much as five hours ($40) per unit over the design, detailing, and building of individual units for a gaging job.

Two sizes of these aluminum die-cast guards are available for through-type dial indicators 2¼ in. in dia and less. The elongated bracket mounting hole for the indicator permits back-and-forth adjustment of 1 in. Housings can be mounted vertically or horizontally, using ¼-20 tapped holes provided. Two sizes are available for 90° dial indicators 2¼ in. in dia and less. When specified, split bushings can be supplied with the housings to handle most standard indicators. All housings are available in blank form without mounting and bushing holes.

AA Industries Inc, 350 Fair St, Ferndale 20, Mich

MORE DATA? Circle 76, inside back cover



Leland-Gifford N/C Drill Has GE Mark II Positioning Controls

Single part, short run, or continuous production drilling can be done with this new tape controlled drilling machine. A GE Mk II numerical positioning control is operated for single part drilling or, if desired, coordinates can be dialed on a console mounted on the drilling machine.

Standard eight channel punched tape is used to control repetitive work. The tape can be programmed to include automatic reversal for tapping and instant stops for tool and speed changes as indicated by flash tool lights.

Self contained closed loop hydraulic circuits and GE Thy-Mo-Trol controlled motor pumps traverse the table with a positioning accuracy of 0.001 in., non-accumulative, and a repeatability of 0.005 in.

The drilling head has a six station turret depth stop, quick change chuck and 5 in. traverse hand feed. Capacity of this unit is ⅞ in. dia in cast iron and a choice of spindle speeds in eight steps from 150 to 1800 or 150 to 3600 rpm is available.

Leland-Gifford, Worcester 1, Mass

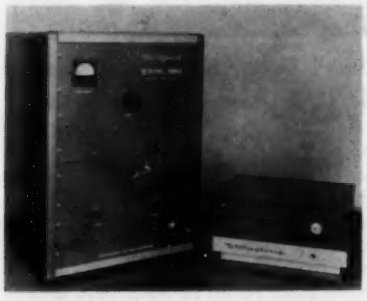
MORE DATA? Circle 77, inside back cover

Scanning Accessory Surface Hardens With HF Generators

Scanning device for surface hardening of metals in rod or shaft form features automatic speed controls, a spring loaded centering device for work mounting, and an air-hydraulic drive for rapid cycling and high production rates. The centers are adjustable for hardening work of various lengths and have limit stops for setting work travel. Standard unit comes equipped with a water trap, but an optional recirculator is available if oil quenching is to be used.

C I Hayes, Inc, 810 Wellington Ave, Cranston, RI

MORE DATA? Circle 78, inside back cover



Westinghouse Ultrasonic Cleaner Features Solid State Circuitry

New 1 kw solid state ultrasonic cleaning generator (right) is 75% smaller than old cleaner yet is reportedly 50% more efficient. Tuning knob and plate current meter have been eliminated on the new generator so that an operator simply turns on one switch to begin cleaning a part.

Size reduction was achieved by integrating a solid state transistor-controlled rectifier in a specially developed circuit that also reduces power requirements by 25%.

The solid state generators will be offered in ratings of 125,250, 500, and 1,000 watts. In addition, a 2½ kw generator is planned for production later this year. Size of the 1 kw model shown above is 8½ x 17 x 14 in., and weight is 60 lb.

Industrial Electronics Dept, Westinghouse Electric Corp, 2519 Wilkens Ave, Baltimore, Md

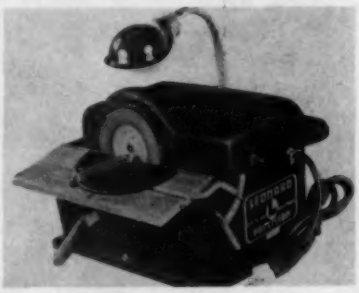
MORE DATA? Circle 79, inside back cover

Lathe Center Aligns Quickly Without Tailstock Adjustment

This precision adjustable center is said to provide accurate alignment in seconds by eliminating tail stock adjustments. Adjustment of the center is made through a hardened and ground feed screw that actuates a dovetail slide. Slide movements of 0.0005 in. are shown on the dial at the side of the center. Slide travel is 3/16 in. each side of center.

Chandler Tool Co, 514 Ohio Ave, Muncie, Ind

MORE DATA? Circle 80, inside back cover

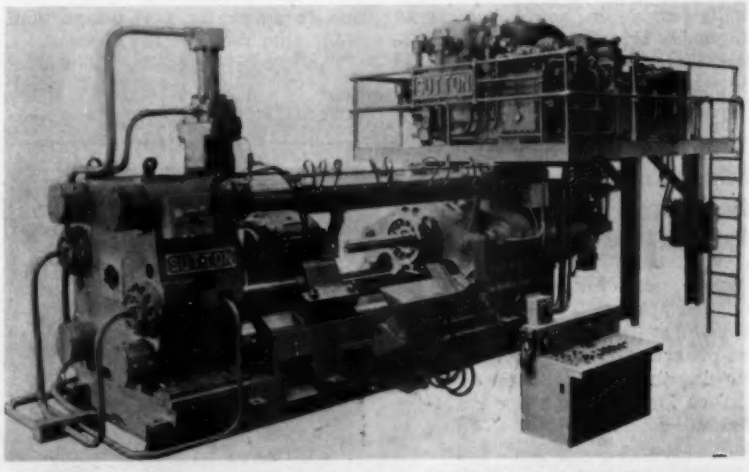


Tool Finisher Holds Ring Wheel In Place With Alnico Magnets

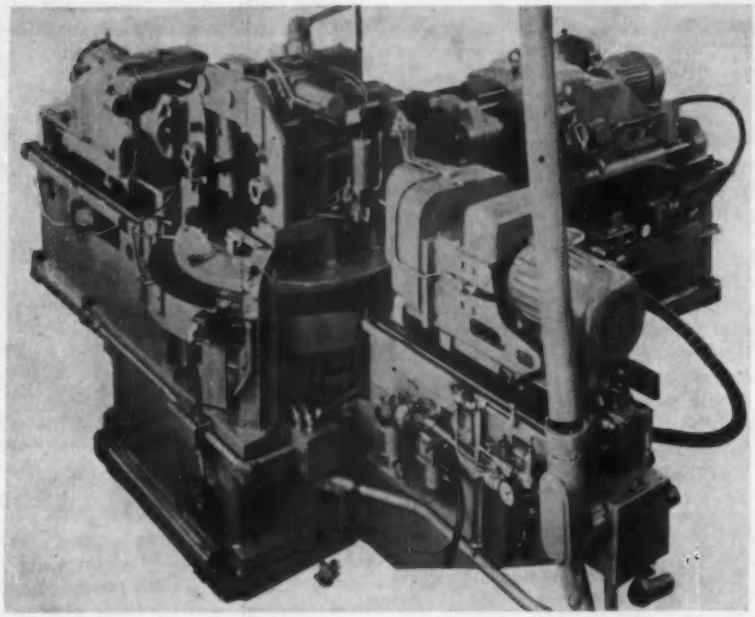
Grind-R-Lap has alnico magnets set into its head to permit quick changing of ring type wheels for grinding and lapping carbide, HSS, and ceramic tools. Tools are held on a wide base protractor which rotates 180 deg and sets and locks at any angle. Degree of table tilt is read from a dial at the side of the machine. The oscillating head moves a diamond grinding wheel that grinds cool and never needs dressing.

Leonard Precision Products Co, Grind-R-Lap Div, 9200 Bolsa Ave, Santa Ana, Calif

MORE DATA? Circle 81, inside back cover



HORIZONTAL PRESS EXTRUDES UP TO 5,000 LB PER HR in fully automatic operation. An operator at an auxiliary panel can control all functions of the press including extrusion speed, container opening and closing, operating die slide, stopping main ram, and emergency stop. Dead cycle of the 1650-ton press is arranged to permit shearing immediately after stripping and also to permit spraying the die while the main ram is returning—*Sutton Engineering Co, First National Bank Bldg, Pittsburgh* MORE DATA? Circle 82, inside back cover



Foote-Burt 11-Spindle Driller, Tapper Adapts to Cylinder Block Design Changes

This 11-spindle drilling and tapping machine rotates 360 deg in four steps to load, locate and unload cylinder blocks and other large components.

In operation, a part slides into an indexing fixture which clamps and locates the part automatically. The fixture indexes 90 deg clockwise and the first of three ways rough-bores and chamfers one 3.8 in. hole and drills four ⅜ in. holes. Another 90 deg index brings the holes into position for a second way to finish and bore the 3.8 in. hole and to drill one 0.438 in. hole. A third 90 deg index allows the last way unit to tap the four ⅜ in. holes. The part is released for unloading after a fourth index.

Total cycle time is 1.77 min, or 27 parts per hr at 80%.

Other machines of this type can be custom made with vertical or angular heads and with milling units built into any station. Also, pickoff gears can be added for speed selection to adapt for part-design, and production requirement changes.

The Foote-Burt Co, Cleveland, Ohio

MORE DATA? Circle 83, inside back cover

Line of Sealed Bearings Runs At High Speeds, in High Temps

A new line of Flexseal bearings, that are said to effectively block out dirt and retain bearing lubricant while operating at high speeds in moderate to high temperatures, has been tested over the last three years in many applications.

The bearing consists of a standard Barden precision bearing with a rubbing seal of fiber-aluminum laminate. The seal, installed in the shield groove of the bearing outer ring, seals against a ground surface on the bearing inner ring. Friction is negligible, according to manufacturer.

Flexeal bearings have been operated up to 3,000 hr at 80,000 rpm without damage or loss of efficiency. They have also tolerated lineal speeds of 6,000 fpm, compared to the usual 2,000 to 3,000 fpm toleration limits for most other sealed bearings. Operating temperatures range up to 300 F for continuous operation.

The bearings are available in ten unflanged and three flanged sizes from 0.3125 to 2.4409 in OD. Prices are slightly higher than ABEC-7 shielded bearings.

The Barden Corp. 200 Park Ave, Danbury, Conn

MORE DATA? Circle 85, inside back cover

Small Drills Sharpened, Inspected In 10 Seconds On Optical Grinder

The Tatar optical drill grinder is said to enable an unskilled operator to sharpen small drills with precision in 10 seconds. Drills are held in a quill equipped with a self centering chuck and swung against a saphire stop. This focuses an image of the drill point on an episcopic projection screen—magnified 10 to 20 times—for inspection.

Grinding of all four facets is done in one sweeping motion back and forth across the face of the cup grinding wheel. To check symmetry of both lip lengths, drill points are

Heat Treated Press Brake Dies Can Be Worked on Location

New line of brake dies are made of heat treated, stress relieved, machine straightened alloy steel and are uniformly strong all the way through. Known as Tufloy, the new dies can be reworked or modified without returning them to the factory.

Dies for 90 and 30 deg air bends, flattening and offset dies, 3 and 4-way dies, and 90 deg gooseneck punches are stocked in 2 through 12 ft lengths. Average die has working shut height of 5¼ in. and fits any standard press brake equipped with die holder and ram adjustment.

Niagara Machine & Tool Works, 683 Northland Ave, Buffalo 11, NY

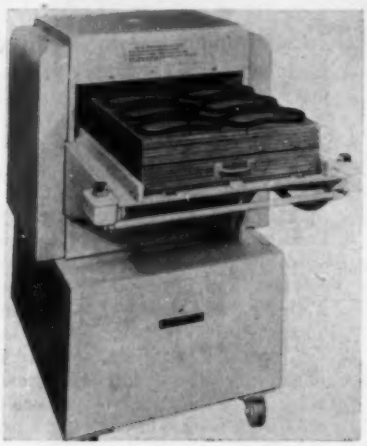
MORE DATA? Circle 84, inside back cover

measured against a built in gage. There is also a built-in diamond dresser that removes a predetermined amount of abrasive from the wheel when the wheel is slid forward against a swivel stop.

The Tatar, which handles drills from 0.0135 in. to 19/32 in. dia, will grind included point angles from 70 to 150 deg and clearance angles from 0 to 40 deg.

Eric R Bachmann Co, Inc, 27-11 41st Ave, LIC 1, NY

MORE DATA? Circle 86, inside back cover



Hydraulic Press Cuts And Trims Parts In One Automatic Operation

Trim-O-Matic hydraulic press cuts out and trims several parts in one automatic operation. The cutting cycle is preset according to the thickness of the material being trimmed and the two start buttons are then pressed to operate the press with a ram force of 16 tons. The 1200-lb machine rolls on four casters and can be plugged into any 115 volt outlet.

Product Packaging Engineering, 5713 Joanne Place, Culver City, Calif

MORE DATA? Circle 87, inside back cover

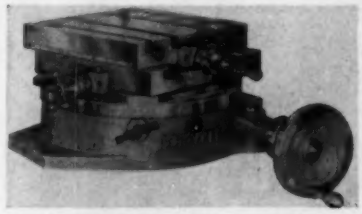
2500 F Heat Treating Furnace Designed for General Purpose Work

SM-AD series is offered for heavy and continuous duty at all levels up to 2500 F, with somewhat higher temperatures available for short or intermittent runs. Rapid heat-up and recovery, extreme flexibility in heating cycles, and availability in a range of sizes with a choice of controls, makes the unit suited for shop, toolroom, or laboratory use.

Foot-controlled air-operated, side-hinged doors enable the operator to keep his hands free for loading or unloading while the furnace is up to heat. Silicon carbide heating elements are positioned over and under the chamber to insure uniform heat transfer. Furnaces are supplied with necessary tap transformer, fine and coarse switches, current input ammeter and contactor.

Pereny Equipment Co, 893 Chambers Rd, Columbus 12, Ohio

MORE DATA? Circle 88, inside back cover



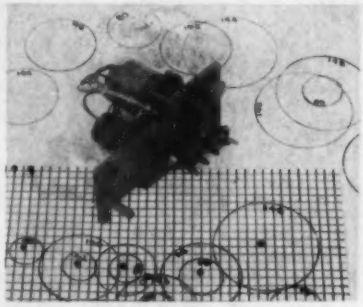
Troyke Cross Slide Rotary Table Has 10-in. Work Surface Travel

Model DMT-15 cross slide rotary table has a 12 x 12 in. working surface that is accurate to 0.001 in. throughout its ten in. of cross slide travel. The combination table has hardened and ground feed screws that are mounted on tapered roller bearings.

Other features of the table include tapered gibs; adjustable, quick-set, cross slide dials graduated in 0.001-in. increments; cross slide scales graduated in 0.100-in. increments; and a rotary table dial graduated in one-minute increments.

Troyke Mfg Co, 11294 Orchard St, Cincinnati 41, Ohio

MORE DATA? Circle 89, inside back cover

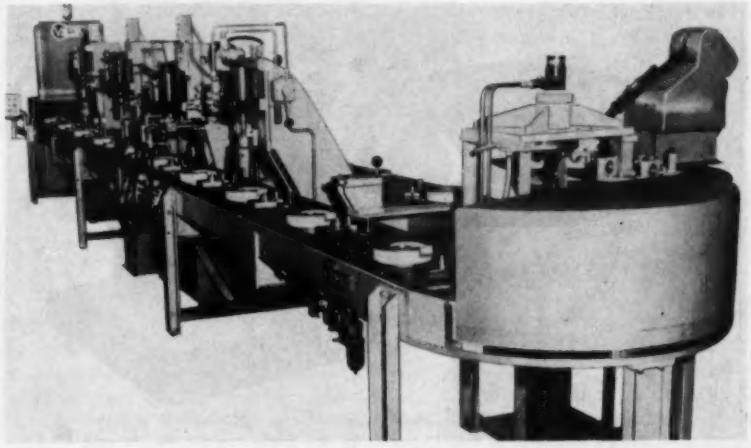


Kit With Plastic Disks, Board Eases Layouts of Gear Trains

Kit for laying out gear trains contains an 8 x 10 layout board marked with 1/10 in. grids, ten color coded center pins, and 100 transparent gear disks. Available in 48, 64, and 96 diametrical pitch, the kits eliminate erasing, redrawing and paper cutouts in gear train layouts. Layout dimensions can be transferred from the precision grid board directly to an assembly drawing.

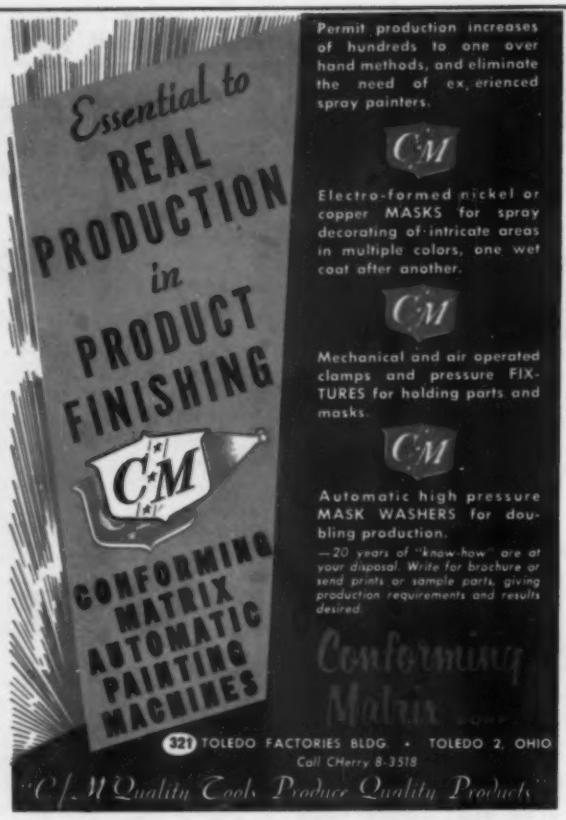
Advanced Designs, Inc, 914 Lullaby Lane South, Vienna, Va

MORE DATA? Circle 90, inside back cover



CONVEYMATIC USES BASIC TRANSFER MACHINE CHASSIS to combine automatic and manual assembly of power-brake booster cylinders for major auto parts manufacturer. Carrousel-type machine, with 30 working platens on each side, produces 250 assemblies an hr with 8 operators and 5 automatic stations—*Visi-Trol Engrg Co, 12720 Burt Rd, Detroit 23, Mich*

MORE DATA? Circle 91, inside back cover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MATRIX
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PAINTING
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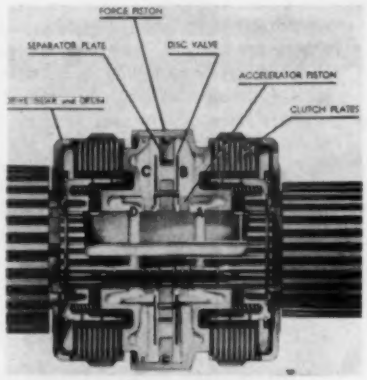
NEW SHOP EQUIPMENT



Torque Modulation In Rockford Clutches Cushions Heavy Loads

New line of hydraulic clutches in six sizes will transmit torque loads of 1,000 to 10,000 lb/ft from engines up to 1,000 hp at speeds up to 5,500 rpm. Automatic torque modulation, or graduated pressure build-up, gives cushioned starts under heavy loads. With this feature, the clutches transmit only enough torque to complete a shift, then continue to maximum capacity. Shift and engagement takes less than 0.6 sec, and when disengaged, the clutch maintains lube oil pressure to the clutch cavities so that all clutch parts are constantly lubricated.

Rockford Clutch Div, Borg-Warner, Rockford, Ill

MORE DATA? Circle 92, inside back cover

HY-HOOK AND NEUTRAL HOOK TAPS are designed to cut specific metals and have hooks and flutes tailored for the job. Hy-Hook taps have a 10 to 12 deg hook and are for tapping aluminum, magnesium, stainless and other metals with stringy chips. Neutral Hook taps (0 to 3 deg) are for cast iron, brass, and other materials with brittle chips

—The DoAll Co, Des Plaines, Ill

MORE DATA? Circle 93, inside back cover

Tool Steel Topics

BETHLEHEM STEEL

A Philadelphia Extruder Reports:

"DIES MADE FROM CROMO-WV DISCS WEAR WELL AT HIGH TEMPERATURES"

In the busy extrusion plant of Michael Flynn Manufacturing Co., Philadelphia, they're getting outstanding service from extrusion dies of Bethlehem Cromo-WV upset-forged discs. The dies, which extrude a variety of aluminum sections, are hardened to Rockwell C47-50. They are particularly impressive because of their long service, and their ability to withstand high-temperature operations.

Cromo-WV (H-12) is ideal for extrusions tooling because of its 5 pct chrome content and balanced analysis which give it high resistance to heat checking. And it has excellent red hardness, plus the ability to withstand shock and wear.

You're sure to like the economy and long service of dies made from Cromo-WV upset-forged discs. Place your order today with your Bethlehem tool steel distributor.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

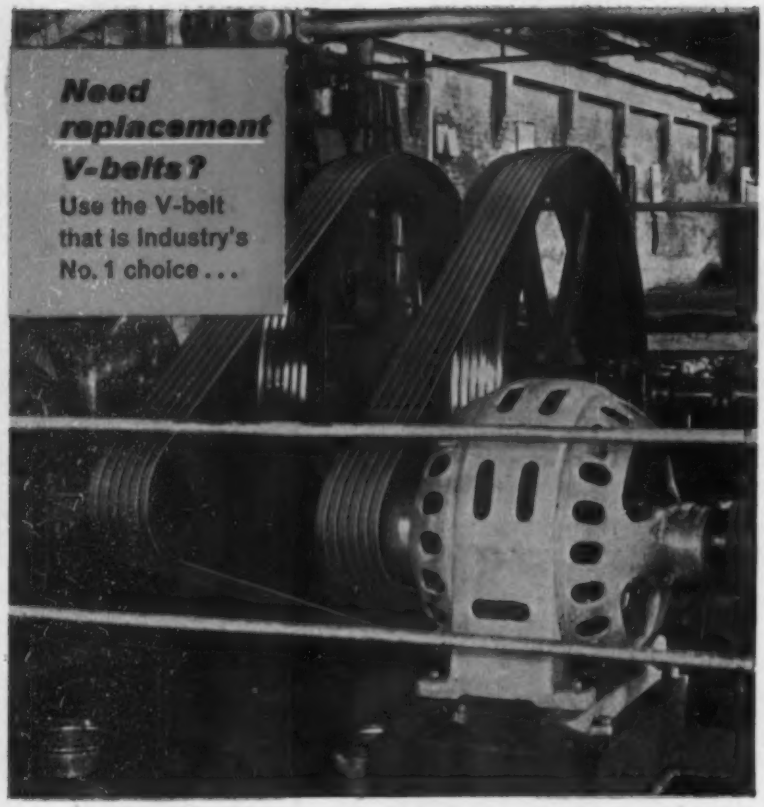
Here's the Way to Grind Tools

After tools are hardened, it is customary to grind them to remove scale and decarburization, or to produce exact dimensions, or both. Basically, the aims are: removal of the desired amount of metal without damaging the hardened surfaces, and the most rapid development of the required surface finish.

It is usually recommended that hardened tools be ground with a vitrified aluminum oxide wheel of 24 to 80 grit. For example, a coarse grit, such as 24, should be used on Bethlehem Lehigh H . . . a high-carbon, high-chrome grade (D-2). The finer grits can be used on Cromo-WV hot-work grade (H-12). The use of soft wheels is suggested. Effective cooling should be done at the point of wheel contact, by using adequate cooling fluid. About .002 to .003 in. should be removed per pass for roughing cuts, and .0005 in. per pass (or less) for finishing cuts.

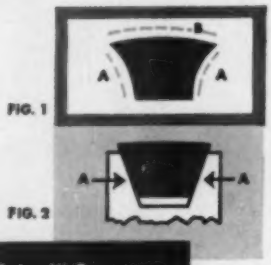
Hand-stone or fiber-wheel brush the tool edges after grinding, to remove burrs. In many shops, these operations have been replaced by a finish grinding pass with a 320-grit wheel. Properly applied, this pass leaves no burr.

CIRCLE 224 READER SERVICE CARD



Gates Hi-Power V-Belts give you longer service life on your drives

Concave sidewalls (U.S. Pat. No. 1813698)—It is easy to see why Gates Hi-Power V-Belts give far longer belt life than ordinary V-belts. *Just make this simple test:* Bend a Gates V-Belt as if it were going around a sheave. Feel how the concave sides (Fig. 1-A) *fill out* . . . become perfectly straight (Fig. 2-A) to make *full contact* with the sides of a sheave. The belt thus grips the sheave evenly, and distributes wear uniformly across the sides of the belt, lengthening belt life.



Precisely-engineered arched top—The arched top (Fig. 1-B) of the Gates Hi-Power V-Belt prevents any distortion of the tensile section cords as the belt bends around the sheave . . . the load is uniformly distributed with each cord carrying its full share.

You will get fast delivery of Hi-Power V-Belts from the local stock of your nearby Gates Distributor. Call him today.

The Gates Rubber Company
Denver, Colorado

BP-6

Gates Hi-Power V-Belts

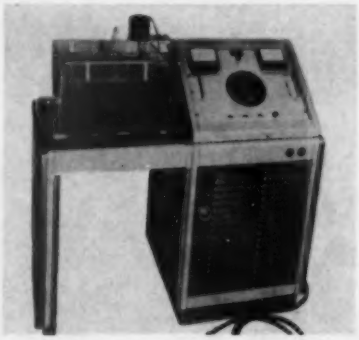
55-ton Press-Rite Introduced by Havir

Model 55 Press-Rite power press is designed to give manufacturers a unit that would handle both large and small size jobs. Features include an extra heavy and fast operating ram slide with long, full V-ram to maintain precision alignment under loads. Full lubrication during fast operations is insured on the front and rear ways when press is upright or inclined. Ram has extra large face area for handling heavy-duty jobs as well as small ones; it also has a special steel removable bushing in the die shank hole in the slide.

Die life is said to be increased up to 50% because of specially designed high tensile cast steel frame which prevents binding and misalignment of dies during heavy blanking and drawing operations. New Havir automatic feed is available on the model.

Havir Mfg Co, 444 Cleveland Ave, St Paul, Minn

MORE DATA? Circle 94, inside back cover



Desk-Size Electrolytic Processor Designed for Hard Anodizing

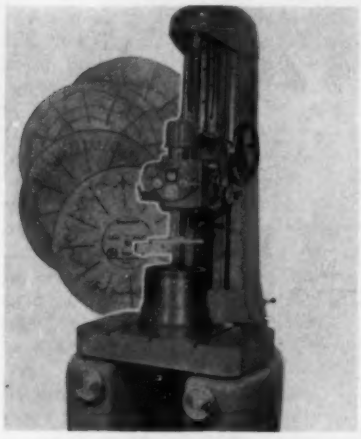
Model 500 Allen-Dizor, designed primarily for hard anodizing, can also be used for sulphuric and chromic anodizing, straight electroplating, chemical and electro-chemical milling, electro-polishing, elec-

trolytic cleaning and etching. Basic components are 1) chemical-resistant lucite plating tank equipped with anode and cathode racks, cooling coil, and agitator; 2) 20-amp rectifier; 3) a 1/3-ton refrigeration unit; 4) desklike console housing the rectifier and refrigeration unit and enclosing the rectifier control and switches.

Optional equipment includes an immersion heater. Operating on 120 v ac, the rectifier delivers 20 amp at 100 v dc, sufficient for hard anodizing 60 sq in. of metal. The 1/3-ton refrigerator can maintain solution temperatures from 20 to 60 F as required.

Allen Aircraft Products Inc, PO Box 271, 4879 Newton Falls Rd, Ravenna, Ohio

MORE DATA? Circle 95, inside back cover



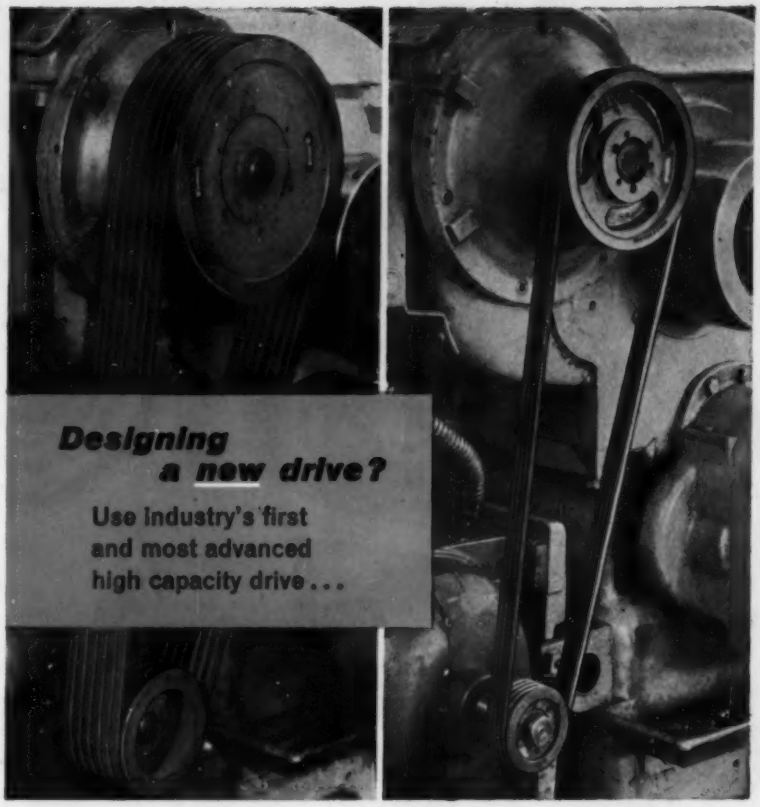
New Talyrond Measures Roundness Of Larger, Heavier Components

Model 2 permits roundness checks of much larger parts than could previously be handled. Worktable can handle components weighing up to 1000 lb and shafts measuring up to 50 in.; when necessary, the table can be removed to provide additional work capacity.

Measurements of roundness, concentricity, coaxiality, squareness, and interrupted circular shapes are permanently recorded on the inkless polar chart. A major advantage of this electronic instrument is that measurements are made and recorded while the test piece remains in a fixed position. The rotating spindle of the instrument, therefore, is not affected by size, balance, or shape of the work.

Engis Equipment Co, Div of Engrg & Scientific Instrumentation, 431 S Dearborn St, Chicago 5, Ill

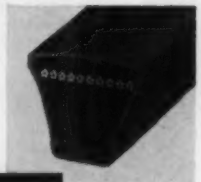
MORE DATA? Circle 96, inside back cover



Gates Super High Capacity V-Belts save drive space, weight, money

If you are designing a new drive, or if the belts and sheaves of a conventional V-belt drive must be replaced, you will benefit many ways by installing a Gates Super HC High Capacity V-Belt Drive.

Gates Super HC V-Belt unites new, high performance materials with a basic change in the shape of the belt itself. Because of this, it is able to handle up to 3 times the horsepower of a conventional V-belt in the same space. As a result, Gates Super HC Drives can often cut in half the space required for your drive. Drive costs are cut as much as 20%, and drive weight reduced 20% and more. Guards can be smaller. Bearing loads are less, increasing bearing life. And the drive can operate at belt speeds up to 6000 ft/min without dynamic balancing!



Exclusive design features include: precisely engineered arched top, concave sidewalls, Flex-Weave cover, super strength tensile construction.

There is a Gates Field Engineer serving your area. To contact him for help in designing a new drive, call your nearby Gates Distributor.

The Gates Rubber Company
Denver, Colorado

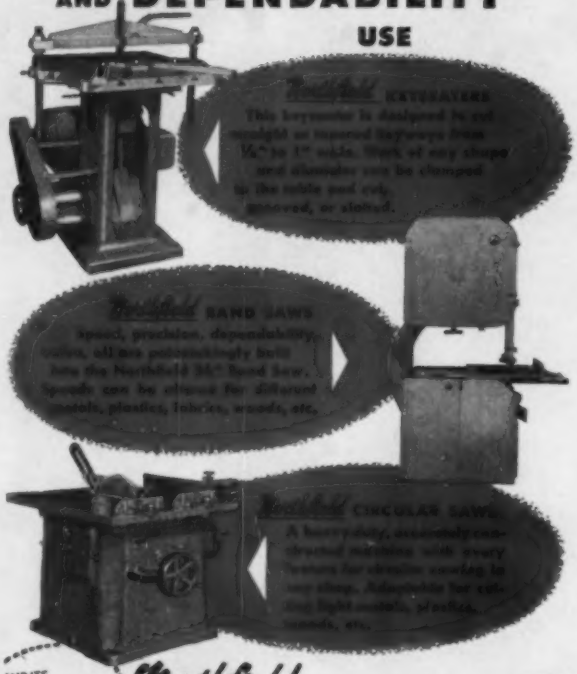
BP-7

Gates

Building the future on 50 years of progress

Gates Super HC V-Belt Drives

FOR **EFFICIENCY**
AND **DEPENDABILITY**
USE



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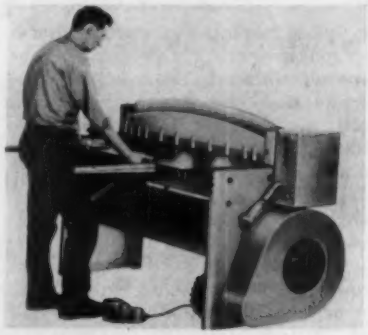
Arthur A. Crafts Co., Inc., 603 Newbury Street, Boston 15, Mass.

NEW SHOP EQUIPMENT



Power Shear Handles 16-Gage Mild Steel at 160 fpm

Di-Acro power Shear No. 48 features cutting action that takes place within one-fifth of a second. Ferrous and non-ferrous material can be sheared to widths up to 50 in.; speed of the machine makes it adaptable for use on conveyor and runout lines.

Instantaneous cycling is possible because the shear is equipped with a self-adjusting electric clutch built into the flywheel and connected directly to the motor by triple V-belt drive. Shearing to die accuracy is also possible because ram is inclined, thus counteracting thrust. Shear blades are at an angle so that only the blade edge is in contact with the material. Micrometer-operated ball bearing back gage is graduated in 0.001 in. Side of gage is also ruled to indicate nearest 1/16 in. and can be angled for special jobs. Cost is $2750 fob.

O'Neil-Irwin Mfg Co, 512 Eighth Ave, Lake City, Minn

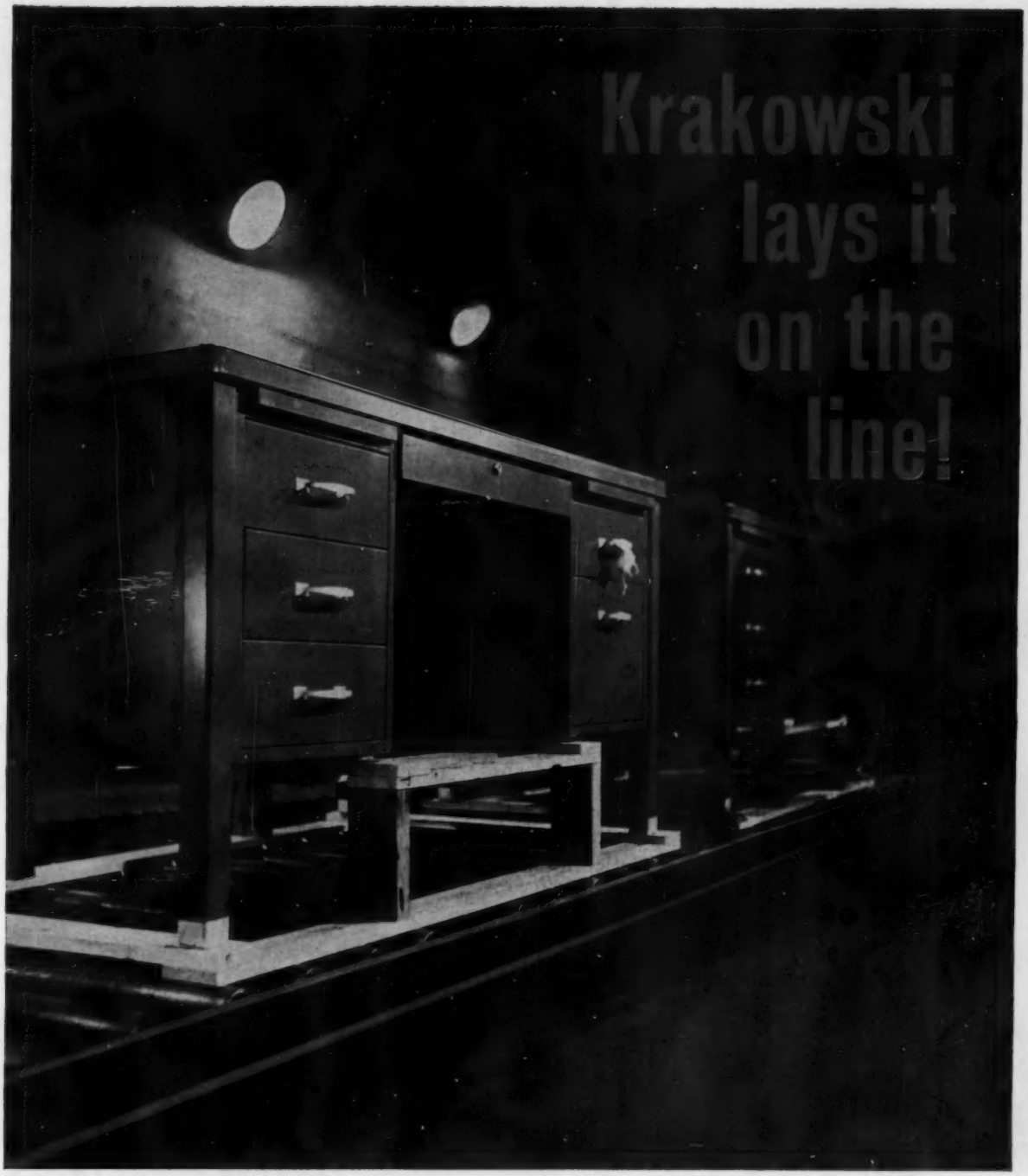
MORE DATA? Circle 97, inside back cover

Solid Carbide Cutters Offered For Weld and Rivet Shavers

New Sonnet line can be used with Zephyr, Quakenbush, Imperial, and other popular makes of weld and rivet shavers and edge mills. The cutters are available as standards in 1 and 1½-in. diameters and in ⅜, ½, and ¾-in. widths. They may be resharpened many times, either in the user's shop or at company's regrinding facilities.

Sonnet Tool & Mfg Co, 576 N Prairie Ave, Hawthorne, Calif

MORE DATA? Circle 98, inside back cover



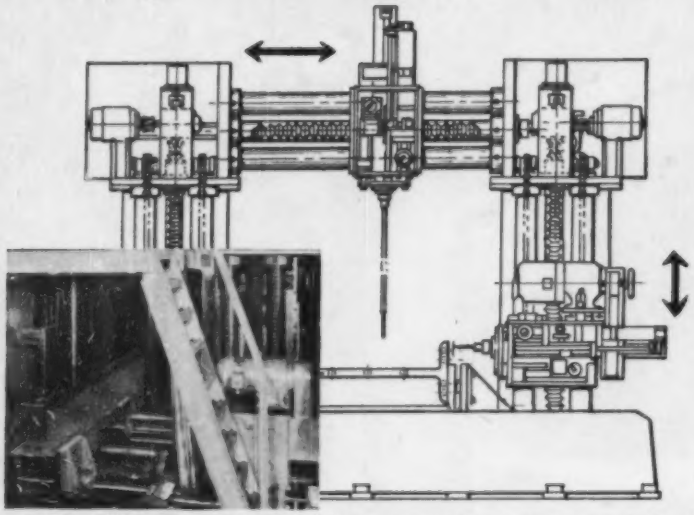
Lou Krakowski, General Superintendent of the Harrison Sheet Steel Company, is a guy who makes no bones about what he wants. It's service! And, for twenty years, he has been getting what he considers the best . . . Cities Service.

Turning out, among many other things, 125 steel desks a day, he wants complete and dependable lubrication service. One of the many Cities Service products he uses to get this job done is Trojan H-2 grease. For general greasing on all equipment, multi-purpose Trojan H grease has a wide range of application. And, because of the variety of jobs Trojan H grease does, it reduces his necessary lubrication stocks.

If you have to *get it on the line* . . . call your nearest Cities Service office . . . or write Cities Service Oil Company, 60 Wall Street, New York 5, N. Y.

CITIES SERVICE
QUALITY PETROLEUM PRODUCTS

Beaver Ball Screws help Mahon save 85% in drilling holes in bridge beams, columns



Close tolerance positioning of massive 1½" capacity vertical and horizontal drill heads is accomplished with Beaver ground-thread ball screws in this new, numerically controlled drilling machine, first in the structural steel industry.

Walter P. Hill, Inc., designed and built the machine for The R. C. Mahon Co., Structural Steel Division

In addition to the important drilling cost savings, it offers repeatability in hole pattern accuracy within ±.005" as compared with ±⅛" by conventional methods and eliminates costly hole reaming in final assembly.

If you are considering data control, Beaver ball screws will give you the power efficiency, positioning control and compactness you need. Our engineers will be glad to work with you just as they did, in this case, with the Walter P. Hill designers.

Beaver Precision Products INC.
CLAWSON, MICH.

NEW SHOP EQUIPMENT

Miller AC-DC Welder Uses Single-Phase Service

The Miller MD, furnished in 300, 400, and 500-amp sizes, incorporates these features: continuous current control; open circuit of 80 v in both ac and dc, plus two wide welding currents in each; straight or reverse dc polarity; semi-metallic rectifier. Forced draft ventilation, dead front construction, and drip-proof cabinet are additional advantages.

Miller Electric Mfg Co, Appleton, Wis

MORE DATA? Circle 99, inside back cover

8-Gage Portable Nibbler Operates On Punch-And-Die Principle

No. 691 sheet metal nibbler develops the pressure of a 2-ton punchpress. As it is fed along the cutting line, small rectangular pieces of metal are punched out, leaving a smooth edge. Metal on either side of the cut is not bent or curled, according to the manufacturer.

Unit operates at 1000 sfpm, no-load 600 sfpm at rated load. It cuts mild steel up to 8-gage on a production basis; stainless and monel of lighter gages; copper up to 3/16 in. Net weight is 16¼ lb.

Black & Decker Mfg Co, Towson 4, Md

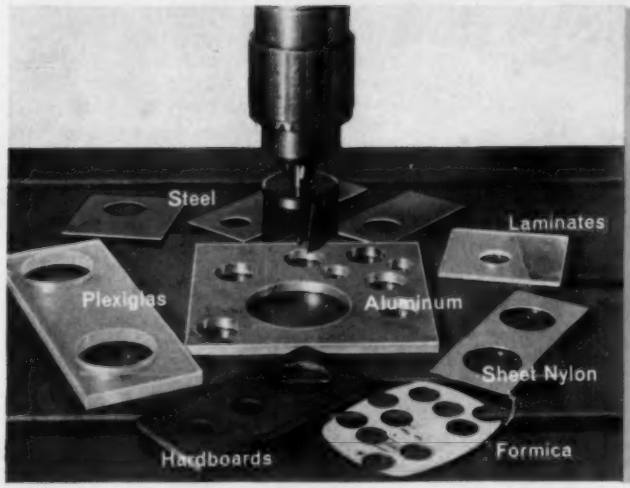
MORE DATA? Circle 100, inside back cover

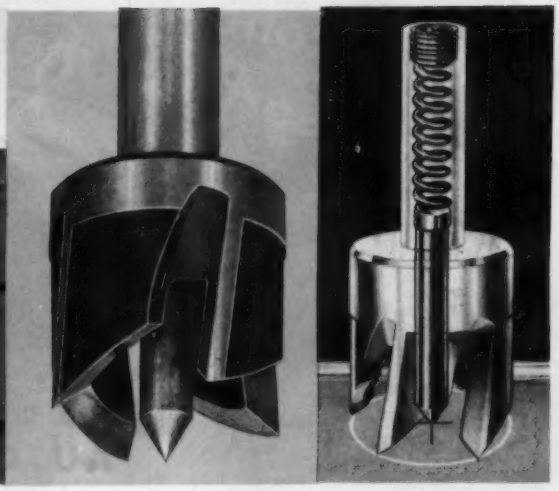
DoALL ECONOMY SPECIAL

A REVOLUTIONARY HOLE-CUTTING TOOL

DoALL

ROTO-BOR





The unique center point is spring-actuated and maintains constant contact with the workpiece under pressure. This results in greater hole accuracy and more accurate positioning. No pilot holes or center punching necessary.

It is the *only* tool that successfully drills accurate holes in both light and heavy gage sheet metal, plate, stainless steel, brass, aluminum, plastics, fibers, cork, rubber—even honeycomb and paper.

This precision cutting tool performs the same operations as a hole saw. But it does it with greater accuracy, to .001", and with more accurate positioning. ROTO-BOR is available in a wide range of sizes with straight or tapered shank. Cutting edges are easily resharpened. If your work involves hole cutting, ROTO-BOR can save you money.

SET RB-A

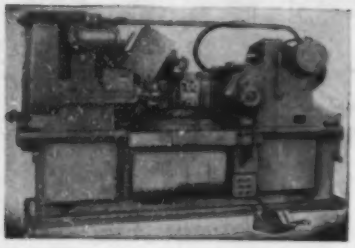
10 sizes—3/16" to 3/4"

$63.50 Less 10% for 30 days only

ORDER TODAY. Call your local DoALL Sales-Service Store. Special offer ends June 1.

CT-66

THE DoALL COMPANY • DES PLAINES, ILLINOIS



GOSS and DE LEEUW
AUTOMATIC
CHUCKING
MACHINE

When any of the various functions for which this machine is designed are performed on it, no further machining is required. The job is finished.

The basic "1-2-3" method . . . exclusive with Goss & De Leeuw . . . provides for gripping work in the chuck and machining all ends either simultaneously or in sequence. By eliminating several handlings and set-ups, the "1-2-3" method produces finished pieces at a fraction of the time and sost ordinarily required.

Send samples of your work for time estimates. Ask for illustrated literature containing detailed information.

GOSS & DELEEUW

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

NEW SHOP EQUIPMENT

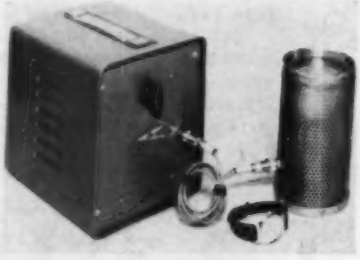
Four-In-One Mig Welding Torch Available in 500-amp Model

The ST-5 for spray arc, short arc, plug, and spot welding can be used with all Sigmatic Mig welding machines, and features an in-line design. All service lines (gas, power, water, and wire) enter the torch through the rear of the barrel; they can be supported on the welder's shoulder for balanced operation.

Cooling system brings water directly into the nozzle body to cool the contact tube, permitting continuous operation at currents up to 500 amp, even with carbon steel welding wire. Aluminum alloy pistol grip handle is adjustable along the torch barrel and is removable to permit using the torch in a mechanized installation.

Linde Co, Electric Welding Dept, 270 Park Ave, New York 17, NY

MORE DATA? Circle 101, inside back cover



Small Ultrasonic Cleaner Has Transducer That Needs No Tuning

Portable bench-size ultrasonic cleaner will clean jewelled bearings, watch movements and other small parts. The cleaning section, which consists of the transducer and tank, is a separate unit connected to the generator by a cable.

No tuning of the magnetostrictive transducer is necessary; therefore inexperienced personnel can work with the cleaner easily. The cleaner tank is large enough for parts up to 1½ in. sq.

Union Ultra-Sonics Corp, Quincy, Mass

MORE DATA? Circle 102, inside back cover

Alemite Accumite® Centralized Lubrication System avoids costly breakdowns, work-stoppage. Automatic positive lubrication protects all machines!

The Alemite Accumite® Centralized Lubrication System comes complete with pump, metering valves and controls. Meters exact amount of lubricant to all bearings whenever system is operated by air, vacuum or manually at any predetermined frequency.

There's no need for a lubrication shutdown. No chance of work spoilage or bearing failure due to over lubrication. The Alemite Accumite System accurately meters .003, .006 or .009 cu. in. shots of oil or grease automatically. Is available with adjustable fittings for applications requiring measured metering from .003 cu. in. to zero. "Snap-On" and "Screw-In" type valves make for complete flexibility in converting existing systems to automatic operation.

You are assured economical, trouble-free operation of equipment. All bearings are sealed against dirt, grit and water. You are able to eliminate the dangers of neglect because all bearings receive proper lubricant in one, automatic, safe operation!

For complete details on Alemite Accumite® Centralized Lubrication Systems for large or small, stationary and mobile equipment (Canning and Labeling Machines • Tractor Trailers and Lift Trucks • Farm Implements • Machine Tools • Textile Machines • Any Machine or Vehicle with Moving Parts) write for your *FREE* Alemite Accumite Catalog . . . today!

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1850 Diversey Parkway, Chicago, Illinois

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FIRST!
in their field . . .

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COOLANT PUMPS

The original motor driven centrifugal machine tool coolant pumps.

First precision made dynamically balanced coolant pumps — *comparable in workmanship to the machine tools they serve.*

First ball-bearing prelubricated coolant pumps requiring no seals . . . no priming . . . minimum maintenance.

First with split-second coolant flow from the moment that the machine is turned on.

Follow the leading machine tool builders . . . specify Gusher Coolant Pumps on your machines.

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MACHINERY CO.
1819 Reading Rd., Cinn. 2, Ohio

machining work held between centers. End of workpiece is gripped by driving pins, eliminating need for clamps, chucks, or dogs. A deformable plastic material serves as a hydraulic medium to give all driving pins an equal bite. Even with irregular surfaces, all pins make contact with the work because the plastic transmits an equal force to all of them.

Eight basic body types of driving centers are furnished and there are three interchangeable pin styles for each, permitting a choice for small, medium, or large work diameters. Different head sizes are available in Morse tapers No. 2 through No. 6.

Power Grip Inc, Rockfall, Conn

MORE DATA? Circle 104, inside back cover

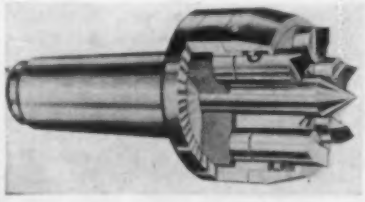
Profile Grinder Polishes, Grinds Contours and Irregular Shapes

Star No. 3, a tilting-table model designed for low-production operations, has a grinding wheel (mounted on a vertical reciprocating spindle) in the center of a counterweighted 18-in. dia round worktable accessible from all sides. To grind a contour on a part, the part is moved on the table around the wheel by hand to bring the desired work areas into wheel contact. The model has wheel speeds of 4500, 6500, and 10,150 rpm. Total wheel reciprocation is 3/16 in.

A 1½-hp motor powers the grinder which occupies a 24 x 30-in. floor space and has table height of from 38 to 44 in. Machine is sold complete with two table center plates, a diamond dresser with diamond-mounted nib, two cup wheel arbors, three socket wrenches, seven mounted pencil grinding wheels from ⅜ to 3 in. dia, and a 3-in. and 4-in.-dia cup type grinding wheel with arbor hole.

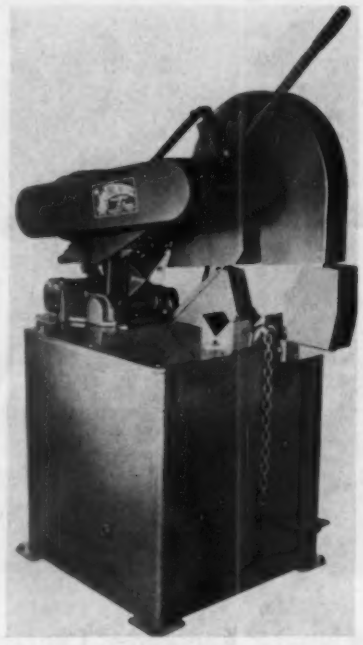
Star Cutter Co, PO Box 376, 34500 Grand River Ave, Farmington, Mich

MORE DATA? Circle 103, inside back cover



Driving Centers Grip Work With Flexible Driving Pins

Use of these units is said to result in greatly reduced setup time for



Two Abrasive Cutting Machines Added To Beaver Pipe Tool Line

New abrasive cutting machine has an oscillating wheel that is said to give greater cutting capacity and longer wheel life. A 20 hp motor powers the wheel, which will cut solids up to 4 in. and other shapes up to 6 in. at a rate of 3 to 4 seconds per sq in.

Speed-Cut No. 11 is a smaller abrasive cutter that will cut solids up to 1½ in. and other shapes up to 3 in. The Speed-Cut has an 11-in. wheel with a 1-in. bore and may be mounted on a stand or on a workbench. Weight of machine is 136 lbs.

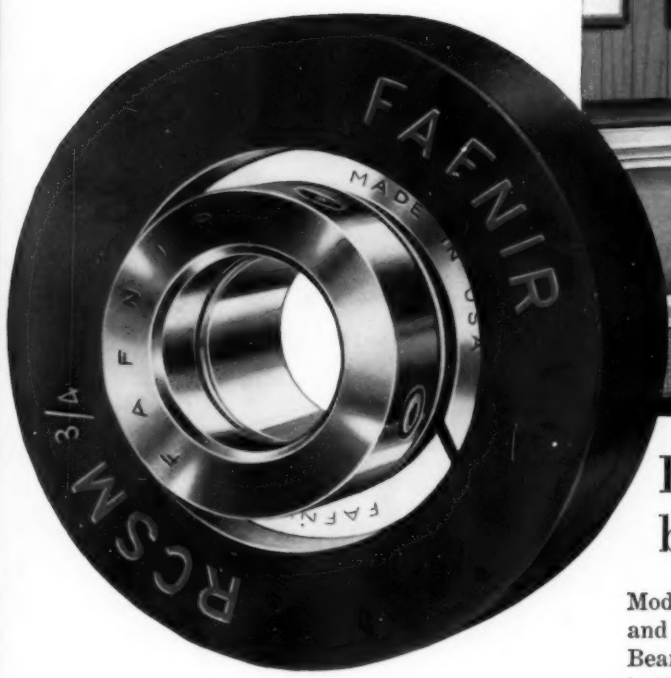
Beaver Pipe Tools, Inc, Warren, Ohio •

MORE DATA? Circle 105, inside back cover

Look to

FAFNIR

for leadership in ball bearings



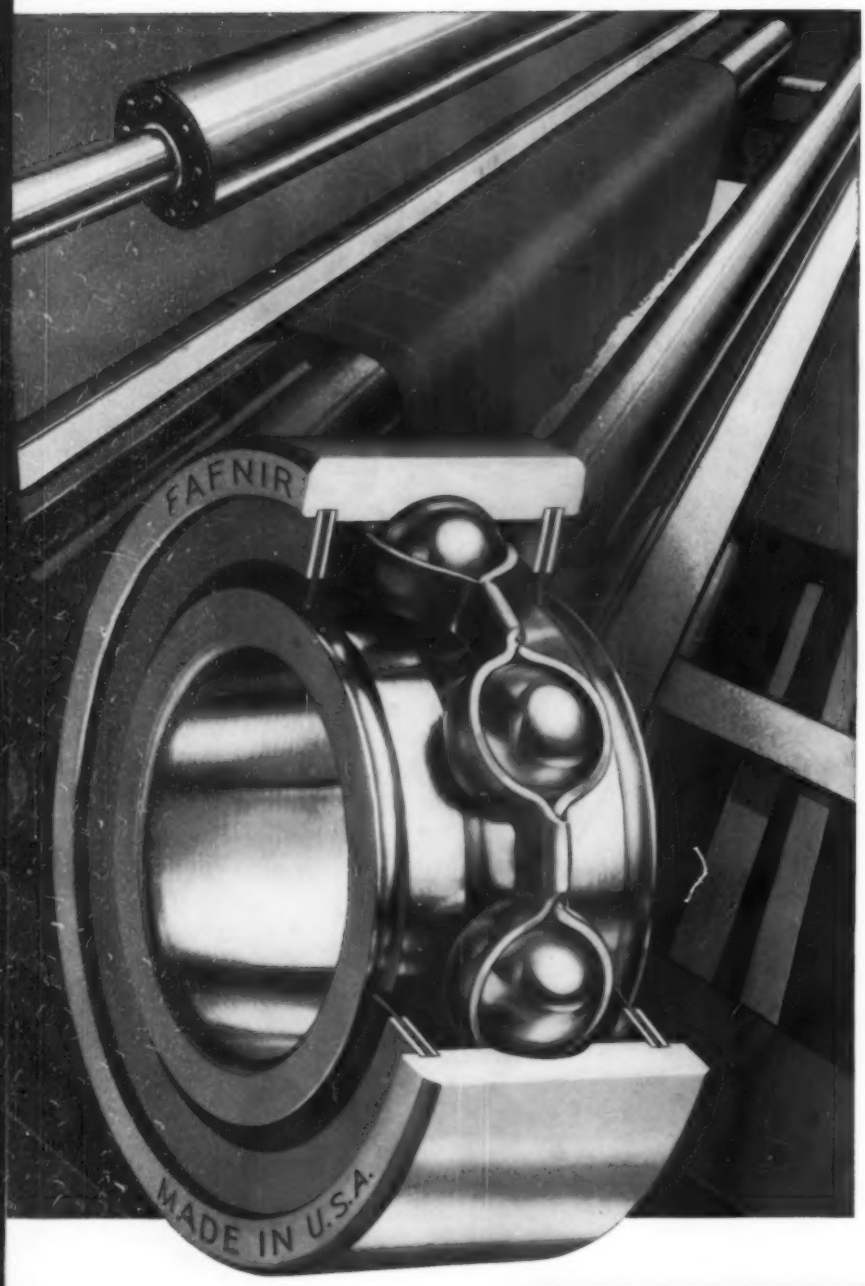
Rubber-cushioned ball bearings that run super-quiet

Modern air conditioning keeps a home comfortable... and does it *quietly*. One reason: Fafnir Super-Quiet Ball Bearings. Developed by Fafnir, these bearings are cushioned in current-conducting rubber to absorb noise. The bearings themselves are specially honed for silent service. Look to *Fafnir* for leadership in ball bearings. The Fafnir Bearing Company, New Britain, Connecticut.

50 YEARS OF EXPERIENCE IN THE MANUFACTURE OF BALL BEARINGS

FAFNIR
BALL BEARINGS

Look to **FAFNIR**

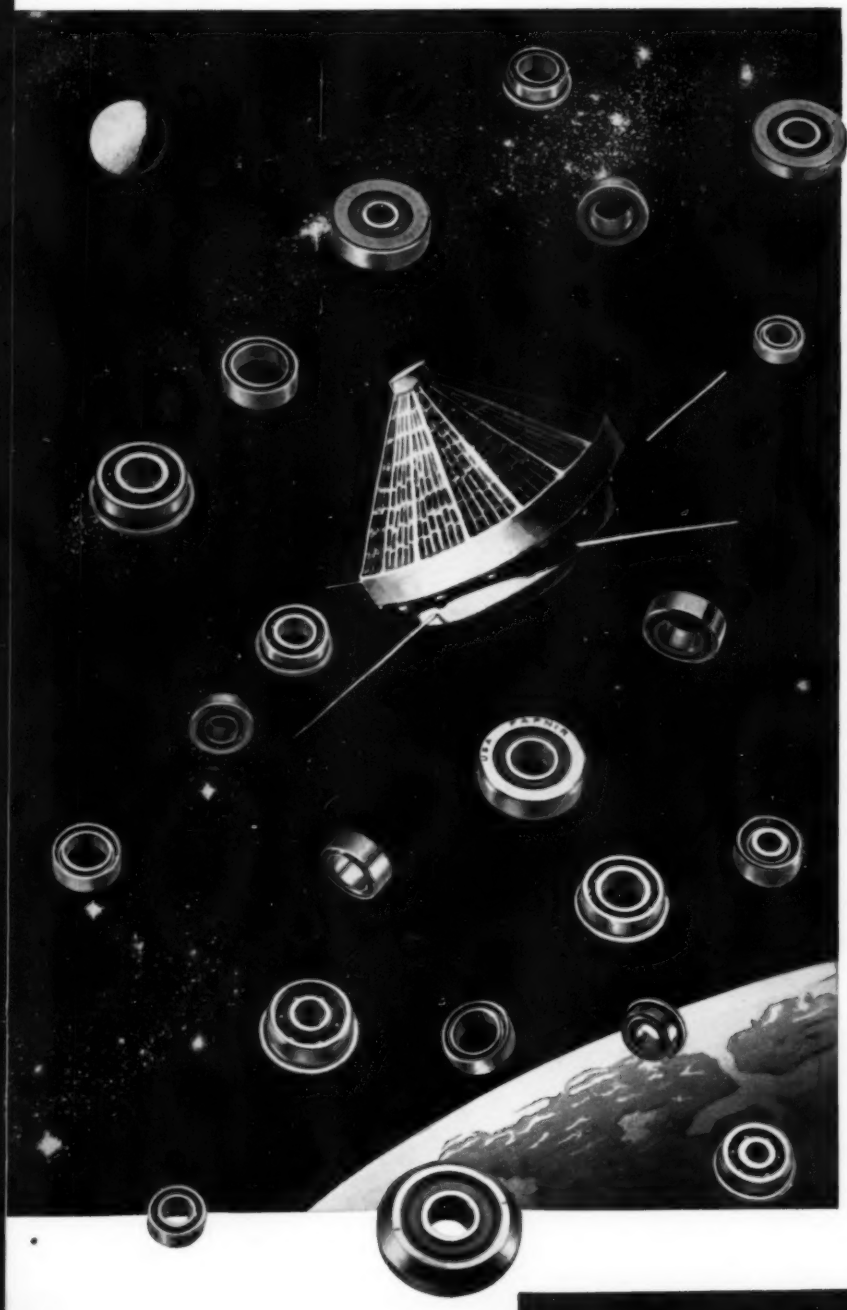


for stainless steel ball bearings that resist corrosion

Textile finishing can "finish off" bearings . . . fast! To control the corrosive effects of moisture, fumes, dyes, and acids, Fafnir developed stainless steel ball bearings with seals designed for extremely severe service. These bearings are used today in a wide variety of textile wet processing equipment. Look to *Fafnir* for leadership in ball bearings. The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR
BALL BEARINGS

Look to **FAFNIR**

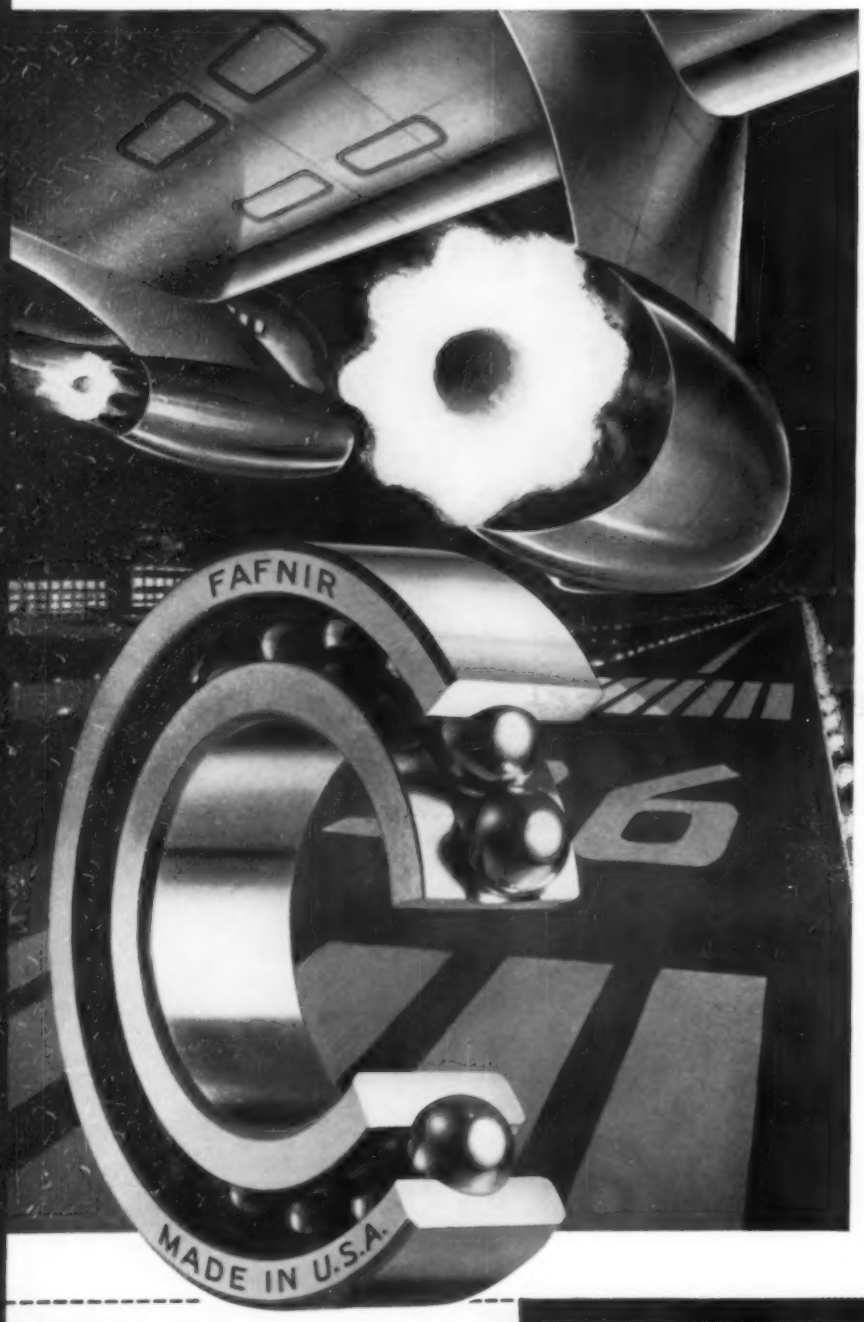


for miniature ball bearings of extra-clean vacuum-melt steel

Seconds after countdown, a microscopic pit in a miniature bearing could ground the most carefully planned space shot. To eliminate pits and other imperfections, Fafnir helped pioneer miniature ball bearings of vacuum-melt stainless steel. This "extra-clean" steel is completely free of impurities, and makes for flawless bearing performance. Look to *Fafnir* for leadership in ball bearings. The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR
BALL BEARINGS

Look to **FAFNIR**



for cobalt-base alloy ball bearings that withstand high temperatures

Air bled from jet engines comes through *hot*. And the pressure is tremendous. For ball bearings that can stand these jet-hot heats and jet-high pressures, Fafnir turned to cobalt-base alloys. These "exotic" Fafnir bearings are ideally suited for turbo-drive butterfly valves and similar high temperature, high load applications. Look to *Fafnir* for leadership in ball bearings. The Fafnir Bearing Company, New Britain, Connecticut.

MADE IN U. S. A.
This stamp on a Fafnir Ball Bearing means finest quality and workmanship . . . dependable supply . . . competent engineering help . . . and responsibility in meeting your bearing needs. It's worth bearing in mind.

THE FAFNIR BEARING COMPANY
NEW BRITAIN, CONNECTICUT

Our ball bearing problem is ☐ Noise ☐ Corrosion
☐ Miniaturization ☐ Heat. Other: .....
We'd like to talk it over with you and get Fafnir's ideas.

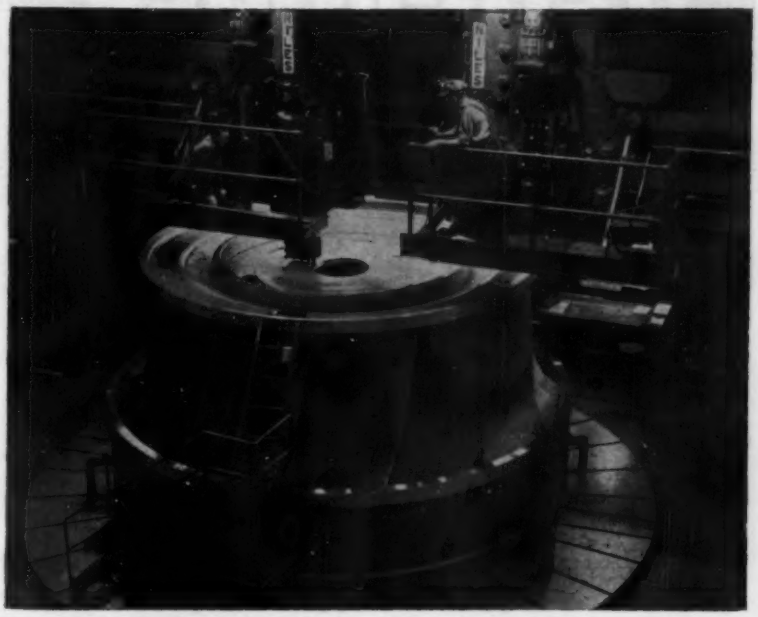
Name .....
Position .....
Company .....
Address .....
City ..... **Zone** ..... **State** .....

FAFNIR
BALL BEARINGS

Ford Motor Co Buys Two Autolite Plants

Ford has purchased for $28 million in cash two manufacturing plants, use of the tradename, and certain other assets of Electric Autolite Co, Toledo manufacturer of electrical equipment. Properties bought by Ford include a battery plant at Owosso, Mich, employing about 350, and a spark plug plant at Fostoria, Ohio, employing 810. Ford plans to continue production at both facilities and doesn't contemplate any personnel changes.

Included in the purchase are certain patent and license rights and the rights to the tradename Autolite, except in Canada, Brazil, and Venezuela where Autolite will continue to distribute is products under the tradename. In addition, Autolite will continue to supply spark plugs and batteries under the tradename to its OEM customers. Ford will now sell spark plugs, batteries, and electrical products bearing the Autolite brand name to distributors and other independent outlets.



95-ton hydraulic turbine runner for the Oahe Reservoir Project in South Dakota is being rough machined at Allis-Chalmers West Allis (Wis) Works on a 30-ft mill. It's one of seven to be installed by A-C in the Oahe Dam power plant for the Corps of Engineers. Each of the turbines is rated 128,500 hp at 100 rpm under 185-ft head. Last of the runners is scheduled to be shipped during early 1963

Eaton Moving Reliance Division From Ohio to the South

The entire Reliance Division of Eaton Manufacturing Co will be moved from Massillon, Ohio, to North Carolina. Construction of facilities there is scheduled to start immediately.

Business of the division, according to a company statement, has shown an overall decline in the last six years, reaching "very unsatisfactory levels." Decline has been accelerated by major increases in foreign imports of industrial fasteners, cold drawn steel, and finished goods containing hundreds of fasteners in each product similar to those produced in Massillon. Labor costs have been another factor leading to the decision to move the two plants to a more economically advantageous location where products could be manufactured at competitively attractive prices.

Studebaker to Turn Out Medium-Duty Diesel Trucks

Studebaker-Packard Corp will produce the first line of medium-duty trucks and tractors equipped with basic, unconverted diesel engines on the US market. Production of the new trucks is scheduled to begin next month. They'll be rated at 19,500 and 23,000 lb gross vehicle weight and 35,000 and 41,000 lb gross combination weight. Power plants will be 4-53 four-cylinder engines made by Detroit Diesel. Advantages of these engines, says Frank T Corcoran, sales manager for Studebaker's truck division, are exceptionally low-cost operation, proved dependability, favorable weight and speed characteristics, and nation-wide availability of parts and service.

Conant Broach Co. . . .

. . . of Chicago has acquired all assets and liabilities of Titan Broach Co of Dolton, Ill. David Stewart, former head of Titan, has been named vice president in charge of operations and elected to the Conant board.

American Chain & Cable Buys Bancroft-Hickey

Purchase of all capital stock of Bancroft-Hickey Manufacturing Co, Bristol, Pa, has been announced by American Chain & Cable Co, headquartered in New York. B-H will continue to manufacture grinding wheels and other abrasive products at its plant. It will be a wholly owned subsidiary and, as such, broadens American Chain's activity in the abrasive field by further expansion of its line of abrasive cutting wheels and abrasive cutoff machines manufactured by the Allison-Campbell Division at Bridgeport, Conn.

Philippine Mill Converts Copper Powder into Strip

Reported to be first of its kind in the world, a new $23 million plant on Mindinao Island is being engineered to turn low-grade ores into high quality copper without any melting processes. This copper can then be converted into strip, tubing, and wire at the same installation.

Foster Wheeler Corp is prime contractor for the project and E W Bliss Co is furnishing its patented rolling and fabricating equipment for converting powder into strip. Also participating are Chemetals Corp of New York, 20% of which is owned by Bliss, and Sherritt Gordon Mines Ltd of Toronto, which owns and licenses the chemical reduction techniques. The Export-Import Bank of Washington has approved a $13 million loan to Marinduque Iron Mines

Versachek + Differential Switching and special fixture provides fast, accurate, low-cost method for passive restraint.

New Concept in Gaging and Control!

Versachek and Height Gage, a standard gaging package

Classifier Unit for Rapid Sorting and Inspection

Multi-Stage Classifiers sort by size ranges, plus over and under

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Every manufacturer can now reap the benefits of high magnification, close tolerance, visual gaging with utmost accuracy and reliability, plus ease and simplicity of operation.

Versachek combines rugged electronic circuitry and experienced gagemaker's craftsmanship to provide a unique combination of features . . .

- Tolerances within millionths, read at a glance.
- Built-in calibration.
- Common zero for all magnifications from 400:1 to 20,000:1, or more.
- Modular design for easy interchange of units without special skills.
- Power output for operating digital recorders, printers and auxiliary equipment.

Above all, Versachek is versatile, using off-the-shelf, modular components. In addition to Height Gage and Comparator Stand, you can use Versachek with Capsules to build custom fixtures and in-process gaging systems, and add the modular units — multiple switchers, classifiers, digital voltmeters — to create either simple or sophisticated control, sorting and feedback systems.

Find out about the many ways Versachek can Pay Off for you! Send for the comprehensive Versachek Catalog with specification and application data. Ask for No. 614.

TPI-1

TAFT-PEIRCE *GAGING*

TAFT-PEIRCE MANUFACTURING CO.
13 MECHANIC AVENUE, WOONSOCKET, RHODE ISLAND

Agents Inc (owner and operator of the plant) for construction of the facility; this is being matched by Marinduque in pesos.

The integrated copper, zinc, and ammonium sulphate plant converts ores into finished copper products by chemical leaching, gaseous reduction, and newly developed rolling methods. Capital cost of the installation to produce high purity copper is 40% less than conventional smelting, refining, and casting plants. In addition to production of approximately 14,000 tons per year of fabricated copper products, the facility will also turn out some 100,000 tons annually of ammonium sulphate fertilizer.

$15.5 Million Orders to Sperry

Sperry Rand Corp's marine division, headquartered at Syosset, LI, has received Navy contracts totaling $8.5 million for manufacture and management of navigation systems in ten new Polaris submarines. Five additional contracts amounting to $7 million will be carried out by the Sperry Piedmont Co division in Charlottesville, Va; these are for gyroscopic and electronic equipment for surface vessels.

New Abrasive Service Center Opened in LA by Carborundum

Carborundum Co and its subidiary, Pacific Abrasive Supply Co, which formerly operated separate office and warehouse facilities in the Los Angeles area, have moved offices and stocks to a new $1.5 million Center in the city. Move to the 75,000 sq-ft facility means a concentration of $1.5 million inventory of abrasives and the first and only complete grinding and finishing systems facility west of the Rockies.

Center, equipped with 30 selected machines and their supporting equipment, is made up of three service departments: grinding wheel, abrasive belt and machine, and barrel finishing. It also provides machine operator training for Carborundum-Pasco, distributor, and customer personnel.

Steel Mill Proposed for Georgia

Construction of a steel mill, which would initially call for a $30 million investment and, eventually, $100 million, is tentatively scheduled for June in the southwest Georgia county of Quitman. Activation of the project is contingent upon two factors: the securing of mineral leases on enough ore-bearing land to insure

a 30-year reserve for the mill, and the proving out of deposits, in Quitman and surrounding counties, to show presence of sufficient iron ore. The plant would be licensed through Strategic Materials Co, Pittsburgh. The facility would utilize a new direct-reduction method with electric furnaces rather than open hearths. It's reported that there is only one other plant of this type in operation now—AAIT's, in Niagara Falls, Ont.

Aerojet Gets $10 Million Contract

Army Ordnance has awarded a $10.9 million contract to Aerojet General Corp, Sacramento, Calif, for production of additional rocket motors for the Hawk anti-aircraft missile. Some $2 million of this will be subcontracted and, of this amount, approximately 85% will go to small business firms.

Ingalls Shipbuilding Corp . . .

. . . Pascagoula, Miss, will build what it terms "the largest hull ever to be constructed of aluminum," a 100 x 50 x 11-ft chemical barge, for Reynolds Metals Co. Designed to carry sensitive liquid chemicals, it'll be used by the National Marine service under a long-term contract with Reynolds. Construction will begin this month with delivery scheduled for July.

Siegler's Olympic Division Opens New Assembly Plant

Olympic Radio and Television Division of Siegler Corp has opened a new facility at Glendale, Long Island, for final assembly of its line of products. Plant has 200,000 sq ft of manufacturing and warehousing area and, at full capacity, will employ 800

AM/MM

"We're rich! The cashier made a mistake and paid me my deductions instead of my take-home pay."

NOW... big machine quality in an economy priced compact band saw

The new Wells **MODEL 300**
METAL CUTTING BAND SAW

Would you like to make your metal cut-off jobs easier and more efficient? Would you like to be able to cut angles, slots, notches and bevels in the same machine?

You can do all of this with the new economical-to-buy and economical-to-use Wells Model 300 Metal Cutting Band Saw.

The Wells Model 300 gives you big 3½" x 6" rectangular capacity—up to 3½" diameter on rounds. It gives you three selective speeds, 54, 100 and 190 feet per minute, to handle a variety of metals efficiently. It features a positive screw action vise, gravity feed and automatic shut-off for horizontal cut-off work. The frame is exceptionally rigid. The entire unit is well guarded and the blade can be changed without removing a guard.

The Wells Model 300 provides exceptional value for the smaller shop or for utility work in the larger shop. It is priced remarkably low for such a well-built, well-performing unit. Ask your Wellsaw Representative for full details or write for Bulletin No. 230.

The Wells MODEL 300 Becomes Completely Mobile With Wheels and Handle

An optional wheels and handle unit makes it easy to move the Model 300 to the job to save time and money.

61-1

SAW SPECIALISTS SINCE 1925

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workers. Current facilities in Long Island City will be maintained to turn out chassis assemblies for the company's consumer product lines and will also house testing and manufacturing facilities for military projects. Olympic, which was merged with Siegler in 1957, is now the largest division in the organization.

Bostitch Buys Calwire

Bostitch Inc, East Greenwich, RI, now in its 65th year of manufacturing stapling and wire stitching equipment, has purchased Calwire Products Inc, and Calnail Inc, its selling organization. Calwire, located in Visalia, Calif, makes heavy-duty stapling and nailing equipment—air-driven, mallet-driven, and hand-operated tools. Manufacture of these products will continue in the California plant.

Astrosonics Sets Up New Laboratory Division

Astrosonics Inc, Syosset, Long Island, developer and manufacturer of sonic products for industry and government, has established a new division, Astrosonic Development Laboratories, reported to be the first in the US designed specifically for applied sonic research for diversified industrial and consumer use. The division will offer facilities and capabilities to conduct contracted research and development in the applications of acoustic wave energy technology.

Watervliet Weapon Contract

Contracts totaling $8 million to produce 235 long-range mobile artillery weapons have been received by Waterville Arsenal, Albany, NY. Orders will not mean any increase in employees but about 40% of the work will be subcontracted to private industry including small business firms not yet selected. Work covers fabrication of tubes, breech blocks and rings, and other breech mechanism components.

Powder Metallurgists Organize in Cleveland

American Powder Metallurgy Institute has established a section in the Cleveland area for engineers, metallurgists, and others interested in the field. Meetings will be held periodically for exchanging technical information and ideas, discussing advances in applications, and to hear speakers on various aspects of the industry. Anyone working in any area of powder metallurgy who is interested in belonging to the Institute and participating in Cleveland Section activities may contact either the Section chairman, C R Halverstadt, Kirkwood Carbon Corp, 4857 W 130th St, Cleveland 35, or the Institute's executive secretary, Kempton H Roll, 60 East 42nd St, New York 17.

Ambulance Order to Memphis Coach

A $1.4 million government contract for 323 ambulances has been received by Memphis (Tenn) Coach Co. The units will be used by the Army, Navy, and Air Force. Order will mean a tripling of employment at the firm for the next eight months, with metalworkers making up the bulk of the increase. Average annual production at the plant for the past few years has been about 125 ambulances. Builder will use Pontiacs (only car that met specifications) as the base of the vehicles, adding 24 in. to the length, extending the drive shaft, and moving the rear wheels back.

Dynamic Gear Acquires Firm

Gear Products & Manufacturing Co, Syosset, NY, has been purchased by Dynamic Gear Co Inc of Amityville, NY. Facilities will be entirely integrated into the parent company's manufacturing organization. Dynamic is currently engaged in the development and production of precision stock gears, components, and complete assemblies for electromechanical instrumentation.

Missile Order to Thiokol

A $4.9 million continuation contract for final assembly and loading of various missile motors at the Longhorn Ordnance Works at Marshall, Texas, has been awarded to the Longhorn Division of Thiokol Chemical Corp by Army Ordnance Ammunition Command, Joliet, Ill. Changes in plant facilities at Longhorn are nearing completion to permit production of the Pershing propulsion system.

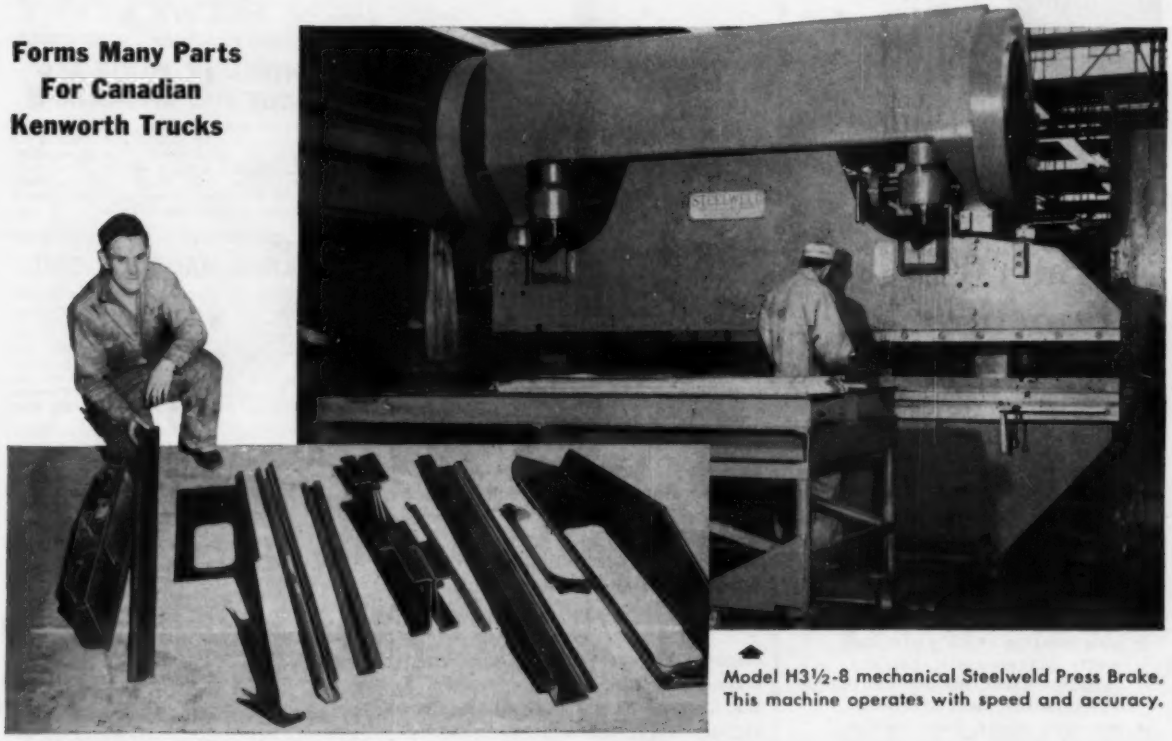
Continental Boat Expands

The Tri-Star Division of Wolverine Aviation Co has been acquired by Continental Boat Corp of Miami. Company plans to manufacture the Tri-Star, a 10-ft boat that can be converted from a rowing to a sailing, or outboard motor craft. The all-stock sale is the fifth acquisition by Continental in the past year. •

Canadian Kenworth model K925
C.O.E. tilt cab with sleeper.

TRUCK PRODUCTION KEEPS STEELWELD PRESS BRAKE BUSY

Forms Many Parts For Canadian Kenworth Trucks



Model H3½-8 mechanical Steelweld Press Brake. This machine operates with speed and accuracy.

A great amount of steel is formed into a variety of shapes on a mechanically-operated Steelweld Press Brake in the modern truck plant of Canadian Kenworth, Ltd., Vancouver, B. C.

Kenworth trucks are custom built to each customer's requirements and are widely used in Canada, the United States, and in many parts of the world where an extra rugged vehicle is required to give satisfactory service.

Since the trucks are made individually, or in small lots, it follows that parts for them are made up in correspondingly small numbers. The Steelweld brake has been found outstanding for this work because of the ease and convenience of the control and gauging devices which permit quick die changes. The bed and ram extension adds to its flexibility of use.

The Steelweld brake, and also a Steelweld shear, have been in continuous satisfactory service since 1955 when the Vancouver plant was put into operation.

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Mechanical and Hydraulic
PRESS BRAKES

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new Di-Acro turret punch press*

Accurate Burr-Free Punching at 12 Rotating Stations

The new Di-Acro 4 Ton Turret Punch Press provides rapid, close tolerance punching of round, square, oval and rectangular holes from 1/16" to 2".

Rotating turrets provide rapid indexing for single or sequence punching. Precision hole location quickly obtained with Micro-twin gauges. Punches sheet metals up to 16 gauge mild steel, fibreboard, asbestos, paper, cork, leather, rubber, plastic and other sheet materials.

Dies are mounted in turrets —always handy. Standard clearance between punch and die is .002". Choice of 6 other clearances at no charge. The Di-Acro Turret Punch Press is safe, simple to operate—requires little maintenance.

See Di-Acro Machines in Action at ASTE Show, Booth No. 1404, May 22-26, 1961, Coliseum, New York City.

*pronounced die-ack-ro

di-acro

DI-ACRO CORPORATION
(formerly O'Neil-Irwin Mfg. Co.)
215 8th Avenue
Lake City, Minnesota

NAMES IN THE NEWS

Burgmaster Corp, Gardena, Calif, manufacturer of Burgmaster turret drilling machines, has appointed **Anttii P Raiha** chief engineer

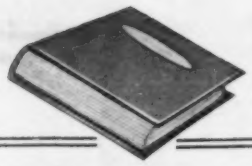
Ford Motor Co has elected **Robert J Hampson** a vice president. He is general manager of the company's tractor operations. **D J Bastian** has been appointed general manufacturing manager, Automotive Assembly Division, Allen Park, Mich. Mr Bastian was formerly plant operations manager.

Norton Co, Worcester, Mass, has appointed **George A Garrison** purchasing agent. **George D Seguin** continues as general purchasing agent for the company. Mr. Garrison has been serving as manager of Norton's west coast plant.

Ex-Cell-O Corp, Detroit, has appointed **Howard H Schrock** district manager of the new office in Downey, Calif. Known as Ex-Cell-O Machinery Sales, it will handle direct factory sales and service of machine tools for Southern California.

General Motors Corp has appointed **Elmer E Braun** general manager of the Central Foundry Division. Previously works manager, he succeeds **James H Smith** who has retired. **Thomas R Wiltse** has been appointed divisional director of reliability. Formerly manager of the Defiance, Ohio, plant of the division, he is succeeded there by **Thomas E Smith.** Mr Smith's former post as manager of the Danville, Ill, plant has been taken over by **Dale W Wonus,** previously production manager of the Saginaw malleable iron plant.

H W Tuttle & Co, Tecumseh, Mich, manufacturer of electrical heating units, has named **J Paul Jones** vice president of engineering and manufacturing. •



ENGINEERING DATA FOR PRODUCT DESIGN

Just Published. A down-to-earth manual of engineering data—ideas, charts, tables, and drawings—for top reliability in modern product design. Covers dielectric heating, radiation characteristics of metals, hi-temp spring materials, metal whiskers, radioisotope applications, and more. **By D. C. Greenwood,** *Product Engrg. Des. Digest.* **448 pp., 635 illus., $10.00**

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Just Published. Provides a comprehensive engineering analysis of machine forces and motions. Use of the unit vector approach helps you clearly determine static and dynamic forces . . . analyze linkages, including space mechanisms, as well as static bearing reactions in gear trains. Includes phase-plane treatment of vibration, cam dynamics, feedback control systems, etc. **By J. E. Shigley, Univ. of Mich. 304 pp., illus., $7.50**

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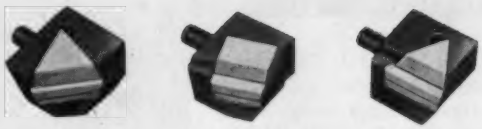

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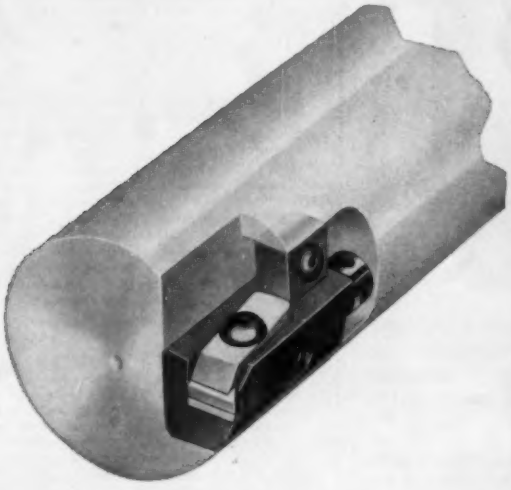

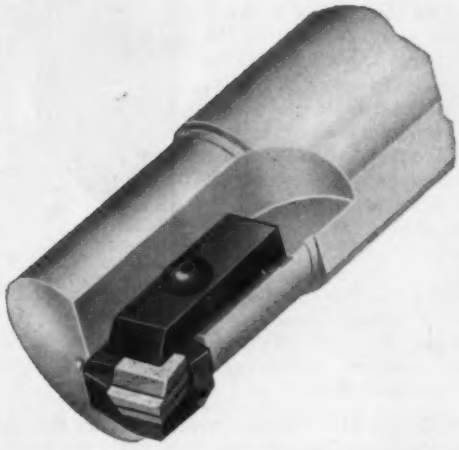

NEW KENDEX* UNITS . . .

for building special tooling more economically

These standardized Kendex units provide a versatile and economical "building block" approach to developing multiple-insert bars and heads for precision machining. They offer many advantages:

1. Only simple milling operations required to provide pockets for Kendex units—much more economical than placing inserts directly in head or bar.
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4. In case of accident, damaged units are quickly replaced.

Other important features are: easy access to adjustment screws; adjustable feature permits compensating for insert wear; all units utilize standard Kendex inserts; positive chip control.

Get complete information about these new cost-cutting Kendex units from your Kennametal Carbide Engineer. Trained to analyze tooling applications and backed by our headquarters staff of tooling specialists, he may be able to help you reduce machine down time, improve production, and increase profits. Ask him for booklet "Kendex Tailored Tooling" or write direct to KENNAMETAL INC., Latrobe, Pennsylvania.

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See these new KENDEX units
at Tool Show in New York—Booth 2445

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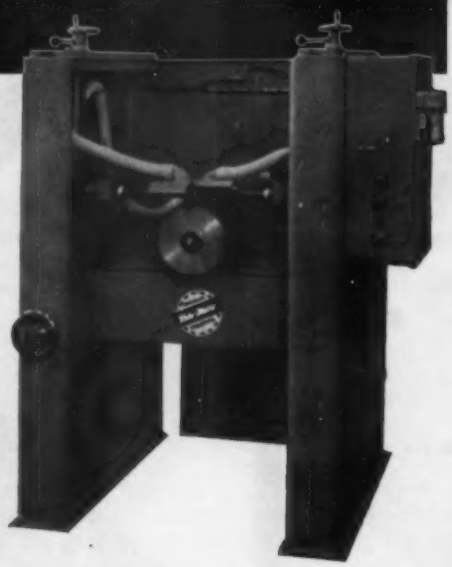
...Partners in Progress

DEBURRING··

No More Hand Filing, Brush or Wheel Removal of Burrs.



ROTO-MATIC Deburring Machines provide the fastest method of removing burrs from SPUR, HELICAL, WORM, HYPOID, BEVEL, SPIRAL BEVEL, SHAFT Gears, SPROCKETS and many irregular surfaces such as cams. Deburring is done at an average peripheral speed of 3 ft. per minute. By mounting the work pieces on a horizontal spindle in a vertical position and employing two floating grinding wheel units, gears are deburred on two sides after one revolution of the work carrying spindle.

Work rotation spindle is mounted on a tilt table so that bevel type gears can be angled anywhere within a range of 90 degrees. Protractors are provided to accurately indicate tilt of table, as well as locate grinding wheel spindles. Vertical position of grinding wheel spindles is adjustable to gear diameters.

With the adjustments provided set up time is reduced to a minimum. After the initial set up has been made the positioning can be charted for future use in the event of a rerun on the same part, further reducing operating time, and making short runs profitable.

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Free Literature

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MACHINES AND ATTACHMENTS

1 AXLE LATHES — *Farrel-Birmingham Co, Consolidated Machine Tool Division, 565 Blossom Rd, Rochester 10, NY.* 10-page bulletin 3001-A pictures and describes new Farrel-Sellers dual-end journal truing and axle lathes. Details cover design and operating features, optional equipment available, and complete machine specifications.

2 BENDING PRESSES — *Pines Engineering Co, 601 Walnut St, Aurora, Ill.* 12-page illustrated bulletin presents data on complete line designed for bending of a variety of parts made of tubing, pipe, rod, bar, and certain shaped stock. Principles, advantages, limitations, procedures, and types of bends covered in detail. Examples of typical applications complete with part description and production figures included.

3 12-IN. CUTOFF MACHINE—*Rockwell Manufacturing Co, Delta Power Tool Division, 400 N Lexington Ave, Pittsburgh 8, Pa.* 8-page illustrated bulletin gives details on four machines: for dry abrasive cutting, for wet abrasive cutting, for non-ferrous cutting, and for wood cutting. Includes specifications, catalog listings, and listings of all motors and motor controls and accessories. Features include increase in power and capacity with no increase in price over previous model; a hollow arbor mist coolant; and a retractable size gage.

4 "PLASTICS MOLDING DATA BOOK"—*Dake Corp, 644 Robbins Rd, Grand Haven, Mich.* 8-page brochure starts with a section which outlines the comparative merits of automatic vs semi-automatic molding of thermosetting materials, and clarifies some misconceptions about the automatic processes. Main body of the publication deals with various models of the new Dake compression molding line including 25 and 50-ton capacity models; 60-ton capacity transfer molding press; the Thredmolder attachment for 50-ton capacity automatic press; and the Automite, designed for short runs and rated at 10-tons capacity.

5 KEYSEATER—*Star Cutter Co, PO Box 376, 8500 Grand River Ave. Farmington, Mich.* 4-page bulletin SC-158 pictures and describes Model 9, an automatic-feed machine for producing precision

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AIR EXPRESS is more than America's fastest shipping service . . . it's the most impartial. Large shipments or small get identical, top priority treatment, plus those "extras" that make AIR EXPRESS first choice nationwide. A special fleet of 13,000 trucks, many radio-dispatched, pick up and deliver door-to-door. Your shipment is first on, first off, first there, via all 35 scheduled U. S. airlines, with kid-glove handling non-stop. And the cost for AIR EXPRESS service is amazingly low. Just one telephone call arranges everything, to 23,000 communities in the U. S. and Canada. It pays when you think fast . . . think AIR EXPRESS first!

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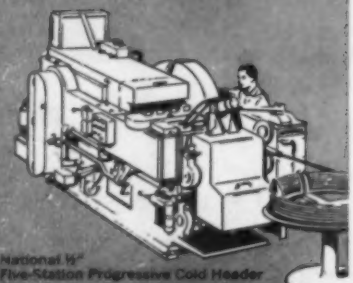
These parts are formed practically scrapless. All achieve remarkable savings over past methods.

If you make odd-shaped parts, may we help you evaluate them for cold-forming from wire? Better yet, come to Tiffin, witness our demonstrations and let's discuss your work.



National ½" Five-Station Progressive Cold Header

NATIONAL MACHINERY CO.

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HARTFORD DETROIT CHICAGO

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keyways up to 1¼ in. wide and 9 in. long in toolrooms and low and medium-rate production operations. Listed on the back cover are a variety of standard work holding fixtures and cutter and guide bar assemblies. Table of standard high-speed-steel keyseater cutters that fit the Model 0 is included.

6 MACHINING THERMOPLASTICS —*Cadillac Plastic & Chemical Co, 15111 Second Ave, Detroit 3, Mich.* 8-page booklet (reprinted from Modern Plastics Encyclopedia) outlines recommended procedures for machining and finishing of thermoplastic sheets, rods, and tubes. Procedures discussed include sawing, routing, drilling, turning, shearing, punching, grinding, and finishing. General recommendations for tool design, feed and speed, and use of coolants are presented. Special machining characteristics of acrylics, nylon, fluorocarbons, and polyethylene are also covered.

7 STRAIGHT SIDE DOUBLE CRANK PRESS—*Dechert Dynamics Corp, 713 W Main St, Palmyra, Pa.* Illustrated brochure describes the Zeh & Hahnemann press; pictures various models available in double crank presses and outlines their construction and design features.

8 HORIZONTAL BORING AND MILLING MACHINE—*S & S Machinery Co, 140 53rd St, Brooklyn 32, NY.* Brochure contains information on the 3-in. Model AL76 Supermill. Design improvements include high precision ways to the head and high-speed headstock. Features illustrated and complete specifications provided.

9 PRESSURE FORMING MACHINE — *Producto Machine Co, Plastics Machinery Division, 990 Housatonic Ave, Bridgeport 1, Conn.* Bulletin describes new Model P-88 laboratory unit with pushbutton control. Reliable heat and pressure systems make it ideal for product sampling and development work.

TOOLS AND ACCESSORIES

10 POWER TOOLS—*Skil Corp, 5033 Elston Ave, Chicago 30, Ill.* 68-page catalog contains complete information on over 100 power tools for use in industry, construction, automotive service, maintenance, and other applications. Included are over 200 illustrations, information on product features, applications, and complete specifications. New products featured include saws, drills, finishing sanders, and a lowcost router. Additional 20-page illustrated catalog covers the 500 line for the consumer field. Eleven new tools out of a total of 19 listed include a ½-in. drill; ¼-in. drill and power unit for Snap/Lock tools; ¼-in. drill kit; ⅜-in. drill; and an orbital sander.

11 DI-PROFILER AND ACCESSORIES—*Engis Equipment Co, Hyprez Division, 431 S Dearborn St, Chicago 5, Ill.* 8-page booklet describes techniques and accessories for the Di-Profiler reciprocating hand machine for filing, lapping, honing, polishing, scraping, and sawing. Applications pictured. Lists complete Di-Profiler sets which include electrical equipment and selected accessories.

12 ROTARY INDEXING TABLE — *Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich.* Data sheet X60A describes the new 7-in.-dia Milichex designed for precision work with small workpieces. The Model MX-3600-7-in. Milichex provides whole-degree angular indexing with an accuracy of ¼ second of arc. Lists all physical dimensions and tolerances, indicates operations in which tables are used, and describes an available adapter plate that permits indexing to minutes and seconds of angles.

13 DIE-GRINDER — *Cleco Air Tools, PO Box 2541, Houston 1, Texas.* 6-page brochure describes new heavy-duty Cleco 125 and gives complete descriptions, specifications, and part numbers for each model available. Unit features an adjustable-speed motor that develops unusually high horsepower. Tool accepts heavy-duty carbide burs with either ⅜-in. or (with optional collet) ¼-in. shanks. Interchangeable long and short spindles are also available.

14 AIR CHUCKS — *Erickson Tool Co, 34250 Solon Rd, Solon, Ohio.* 4-page catalog L, section D, illustrates and describes three styles for work or tool holding in rotating and non-rotating applications. Lists specifications for the 400, 500, and 600 series of '01, '09, and R-type chuck styles, plus specification table of Erickson collets, and pictures several money-saving applications of the air chucks in precision, high-production work.

15 QUICK-CHANGE TOOLING SYSTEM — *DeVlieg Microbore Division, Fair St, Royal Oak, Mich.* 4-page illustrated publication FC-2-61 describes built-in features of Flash-Change toolholders which permit cutting tools at machines to be changed in seconds. Pictures and details styles and adapters available for a wide range of machine tool spindles.

16 GAGE PLUGS—*Moore Products Co, H & Lycoming Sts, Philadelphia 24, Pa.* 8-page bulletin 8009 presents illustrated data on universal plugs for Moore pneumatic comparator gages. The company's universal plug system is described; components are illustrated by engineering drawings; specifications of standard and semi-standard plugs are tabulated and discussed; dimensions and ordering information are included.

17 CHUCK JAWS — *Royal Machine & Tool Corp, 31 Deming Rd, Berlin, Conn.* 8-page bulletin JR361 pictures and describes Grip-Lock custom chuck jaws and special holding devices. Pictures and discusses step-by-step fabrication of these units.

18 SURFACE ROUGHNESS MEASURING INSTRUMENT—*Micrometrical Mfg Co, 3821 S State Rd, Ann Arbor, Mich.* 8-page brochure provides detailed

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"Heh, heh, let's see that checker find THIS error!"

HANDY ALLOY DATA SHEET

HANDY & HARMAN ENGINEERING DEPARTMENT
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EASY-FLO	50	15½	16½	(18 Cd)	1160	625	1175	635	5.0
EASY-FLO 3	50	15½	15½	(16 Cd-3 Ni)	1170	630	1270	690	5.0
EASY-FLO 45	45	15	16	(24 Cd)	1125	605	1145	620	4.9
EASY-FLO 35	35	26	21	(18 Cd)	1125	605	1295	700	4.9
SIL-FOS	15	80		(5 P)	1185	640	1300	705	4.5
SIL-FOS 5	5	88¾		(6¼ P)	1185	640	1300	705	4.4
TEC*	5			(95 Cd)	640	340	740	395	4.6
TEC-Z*	5		16.6	(78.4 Cd)	480	250	600	315	4.5
BRAZE 071 (SN #7)†	7	85		(8 Sn)	1225	665	1805	985	4.8
" TL	9	53	38		1410	765	1565	850	4.5
" ATT	20	45	30	(5 Cd)	1140	615	1500	815	4.6
" 202 (AT SPEC)†	20	45	35		1315	715	1500	815	4.7
" NE	25	52½	22½		1250	675	1575	855	4.7
" 251 (AE)†	25	57½	17½		1270	690	1625	885	4.7
" NT	30	38	32		1250	675	1410	765	4.7
" DT	40	36	24		1235	670	1415	770	4.8
" SS	40	30	28	(2 Ni)	1220	660	1435	780	4.8
" 404 (SS-5)†	40	30	25	(5 Ni)	1220	660	1580	860	4.7
" DE	45	30	25		1225	665	1370	745	4.8
" ETX	50	34	16		1250	675	1425	775	5.0
" 541 (4772)†	54	40	5	(1 Ni)	1340	725	1575	855	5.1
" 560 (ER)†	56	22	17	(5 Sn)	1145	620	1205	650	5.0
" 580 (EB)†	57½	32½		(7 Sn-3 Mn)	1120	605	1345	730	5.1
" RT	60	25	15		1245	675	1325	720	5.0
" 603 (RT-SN)†	60	30		(10 Sn)	1115	600	1325	720	5.2
" 630 (RSNI)†	63	28½		(6 Sn-2½ Ni)	1275	690	1475	800	5.1
" EASY	65	20	15		1240	670	1325	720	5.1
" 655 (RE-MN)†	65	28		(5 Mn-2 Ni)	1385	750	1560	850	5.2
" MEDIUM	70	20	10		1275	690	1360	740	5.1
" BT	72	28			1435	780	1435	780	5.2
" HARD	75	22	3		1365	740	1450	790	5.3
" 752 (TR #1)†	75		25		1300	705	1330	720	5.1
" IT	80	16	4		1340	725	1490	810	5.3
" 852 (85 Ag-15 Mn)†	85			(15 Mn)	1760	960	1780	970	5.1
PREMABRAZE 610	61	24		(15 In)	1155	625	1305	705	5.0

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This informative booklet gives a good picture of silver brazing and its benefits...includes details on alloys, heating methods, joint design and production techniques. Write for your copy.

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For { 8-STATION PRODUCTION MACHINING
1½" BAR AND COLLET WORK
CHUCKING
SINGLE POINT THREADING

Costs { $7,167.00 FOB Factory Complete with all standard equipment

This is an all new 1½" bar capacity ram type turret lathe with power feeds to all 8 working stations . . . that in addition to bar and collet work also has the versatility to do chucking, and when needed, single point threading.
Powered by a 5 h.p., two-speed, geared motor, the new Sheldon 3 R turret lathe provides 16 spindle speeds, 60 different feeds to the carriage and cross-slide, and 180 different feeds to the ram turret.
The turret itself is ruggedly built and accurately machined to provide close tolerance indexing. And for complete ease of operation, it is put under power by simply pressing a push button on the control panel.

This new 3 R Sheldon is completely equipped with two-speed motor and electrical controls, coolant system and splash guards, LO spindle nose, large satin chrome dials and hardened bed ways. It also provides an additional cost saving feature—each turret face is drilled and tapped for your standard flange type tooling as well as being bored for your standard 1½" shank type tooling.
For versatile, accurate machining in either long or short runs, the new Sheldon 3 R provides the answer to low investment cost with high profit operation.

New SHELDON
3R-TURRET LATHE

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Write for bulletin with complete specifications and tooling data

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19 INSERT CHASER DIE HEADS — *Eastern Machine Screw Corp, New Haven 6, Conn.* 4-page bulletin 12D contains details on H&G stationary dies heads, Styles DMS self-opening and DMSL with alignment feature, and H&G throw-away insert chasers. These stationary die heads are for use on turret lathes, hand screw machines, and similar applications where the die head does not rotate.

20 HSS BANDSAWS—*H K Porter Co, Disston Division, Pittsburgh 19, Pa.* 6-page brochure describes features of blades and provides tabular data on teeth per inch (per material thickness) and band speed (feet per inch) for 19 materials. Standard blade specifications are listed for regular pattern and lancer (hook).

HEAT TREATING AND WELDING

21 METALLURGY OF ELECTRONIC WELDING — *Hughes Aircraft Co. Vacuum Tube Products Division, 2020 Short St, Oceanside, Calif.* 17-page technical report covers laboratory studies on 1) the resistance welding process; 2) significant factors in resistance welding; 3) evaluation of weldability of various materials; 4) weldability of clad materials; 5) dissimilar materials. Report is illustrated with photos of magnified welds and includes charts and graphs.

22 SILVER BRAZING ALLOYS — *Air Reduction Sales Co, 150 E 42nd St, New York 17, NY.* 24-page revised, expanded manual (form ADC 847C) fully illustrated and diagrammed, discusses brazing procedures, problems, and solutions. All Aircosil silver brazing alloys, from those in standard rod forms to the new Aircosil Fluxcor 45 which incorporates the fluxing agent in the center of the wire, are de-

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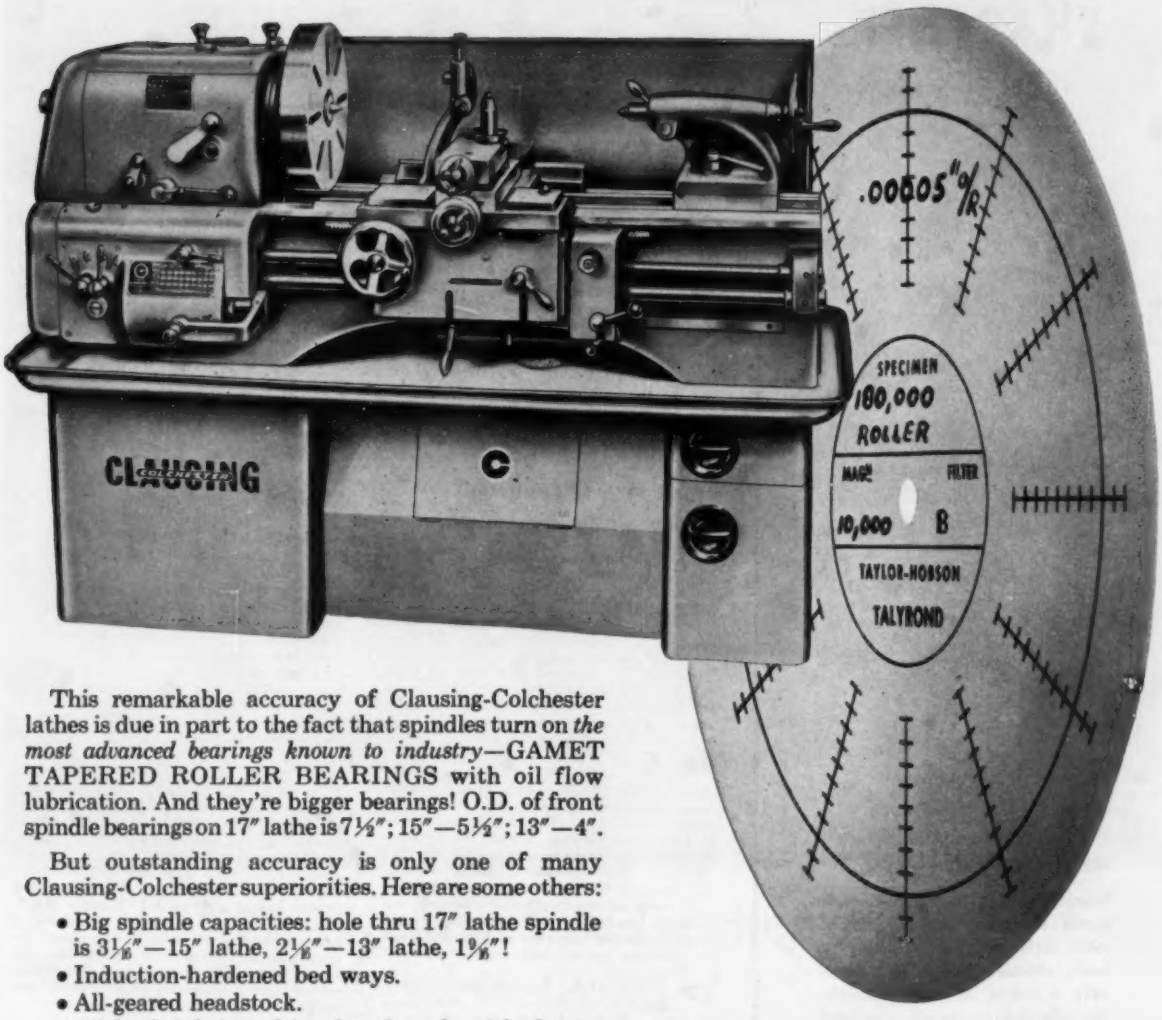

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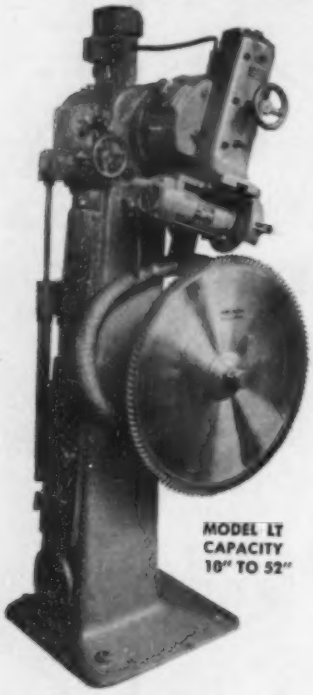

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scribed, stressing advantages and applications. Charts aid in the selection of the proper alloy to meet particular needs.

23 HEAVY-DUTY AC/DC WELDERS — *National Cylinder Gas Division, Chemetron Corp, 840 N Michigan Ave, Chicago 11, Ill.* Illustrated bulletin NH-185 provides information on six models of the NCG combination ac/dc metallic arc welder. Models provide rated output of 300, 400, and 500 welding amp at 60% duty cycle and are available with or without power factor correction. Features are listed, an illustration shows dimensions, and a specifications table gives welding current ranges, power input, for each. Optional running gear is described and illustrated.

24 VACUUM FURNACES — *Consolidated Vacuum Corp, 1775 Mt Read Blvd, Rochester 3, NY.* 24-page bulletin 4-25 presents illustrated information on vacuum metallurgy; vacuum arc melting furnaces (laboratory and production types); vacuum induction heated furnaces (melting and casting, sintering and heat treating); vacuum resistance heated furnaces (indirect heated and direct heated). Technical data on each is given in tabular form.

PLANT SERVICE EQUIPMENT

25 CHEMICALS FOR ULTRASONIC CLEANING — *Branson Instruments Inc, 40 Brown House Rd, Stamford, Conn.* 14-page bulletin S-700 gives detailed information on physical properties of most commonly used products together with suggested applications, working temperatures, and procedures. Fourteen different types of cleaning media are tabulated, divided into two main groups—aqueous solutions, and solvents. Technical data covers concentrations, operating temperatures, safety handling measures, and proper uses.

26 INDUSTRIAL VACUUM — *Breuer Electric Mfg Co, 5100 N Ravenswood Ave, Chicago 40, Ill.* 18-page brochure illustrates and describes 79 time and money-saving cures for reducing cleaning maintenance costs through use of the Tornado Series 400. Enables the reader to rate the efficiency of his present cleaning methods and suggests improved ways to accomplish such tasks as one-step boiler cleaning; recovering materials and salvaging usable waste; cleaning electrical motors and panels; cleaning air of dust and abrasives.

27 ALUMINUM FINISHING PROCESSES—*MacDermid Inc, Waterbury 20, Conn.* Technical data sheet 24 lists a full range of aluminum finishing processes including compounds used in anodizing, bright dipping, burnishing and barrel finishing, chemical milling, chromate conversion coatings, corrosion protection, deburring, electropolishing, pickling, plating, prepainting treatment, rinsing and drying, spotwelding, stripping.

28 CONVEYOR CONTROL SYSTEM—*Condeco, Control Design & Fabricate Inc, 30725 12 Mile Rd, Farmington, Mich.* 8-page brochure describes and illustrates a new conveyor material handling control system. Entitled "Selector Systems," it gives information on the Elector and Mimic consoles developed for simplified, economical control of conveyor distribution.

29 ULTRASONIC CLEANING SYSTEMS — *Acoustica Associates Inc, General Ultrasonic Division, 10400 Aviation Blvd, Los Angeles 45, Calif.* Bulletin covers new self-tuning, transistorized 20-KC line. Advantages over older vacuum tube systems include lighter weight and compactness; choice of selectable power levels; automatic compensation for load and liquid levels; simple on-off control; no warm-up time; limited maintenance; overall efficiencies in the order of 80%.

30 CHEMICAL SAFETY—*Manufacturing Chemists' Association Inc, 1825 Connecticut Ave, NW, Washington 9, DC.* Revised editions of four safety data sheets on Benzene, SD-2; Nitric Acid, SD-5; Paraformaldehyde, SD-6; and Anhydrous Ammonia, SD-8, list not only the characteristics of these chemicals but also the hazards, engineering control of hazards, employee safety procedures, fire fighting techniques necessary, recommended handling and storage practices, tank and equipment cleaning and repair procedures; waste disposal; and first aid requirements.

31 CASTERS AND WHEELS—*Saginaw Products Corp, 63 Williamson St, Saginaw, Mich.* 35-page catalog CW-61 contains illustrated data on industrial pneumatic and precision casters; industrial and pneumatic wheels. Company's Red-Tred polyurethane wheel line is featured. Sections on special caster accessories and military specification casters and wheels are included.

32 CLEANNAIRE CABINET — *Plastigage Corp, 915 E South St, Jackson, Mich.* Illustrated brochure describes cabinet for use wherever a dust-free environment is required in precision and high reliability operations such as white rooms, laboratories, and model shops.

PARTS AND MATERIALS

33 CARBIDE DIES—*Oberg Manufacturing Co, Freeport, Pa.* 52-page illustrated bulletin 261 contains descriptions of numerous progressive rotor-stator dies, full pierce rotor-stator dies, synchro motor dies, progressive E & I and ballast dies, thick material dies, special shape and form dies, and carbide slot or index dies. Construction assures 100% interchangeability of parts. Charts are included on carbide selection, characteristics, and calculation formulas on blanking pressures and stripping pressures.

34 TOOL STEEL AND CARBIDE GRADES CHART — *Brace-Mueller-Huntley Inc, Syracuse, Rochester, Buffalo, NY.* Revised, simplified comparison chart shows how Allegheny Ludlum Steel's products rank with those of other producers at any given time. Also lists typical analyses and characteristics of the major steel grades available from A-L through BMH. Steelector bar graphs present 18 grades of tool steel and show which is best suited for maximum performance on a particular job. The 18 selected grades are distributed among three categories—high speed, hot work, and tool room.

35 CLAMP ASSEMBLIES AND FIXTURE COMPONENTS — *Accurate Bushing Co, 440 North Ave, Garwood, NJ.* 12-page catalog JF-61 contains complete information and drawings of the more than 1000 ABC items available from stock. Separate price list, JFP-61, is included.

36 PNEUMATIC PRODUCTS — *C A Norgren Co, 5400 S Elati St, Englewood, Colo.* 64-page catalog 1000 covers complete line of company's products including compressed-air-line filters, pressure regulators, air-line lubricators, valves. Engineering information includes compressed-air flow chart; moisture content of saturated, compressed air; dimensional data.

37 COPPER-BASE ALLOYS — *Ampco Metal Inc, PO Box 2004, Milwaukee 1, Wis.* 16-page bulletin G-60 includes chemical compositions, physical properties, and typical applications of a series of special wear and corrosion-resistant copper-base alloys. Forms in which each is available are listed. ●

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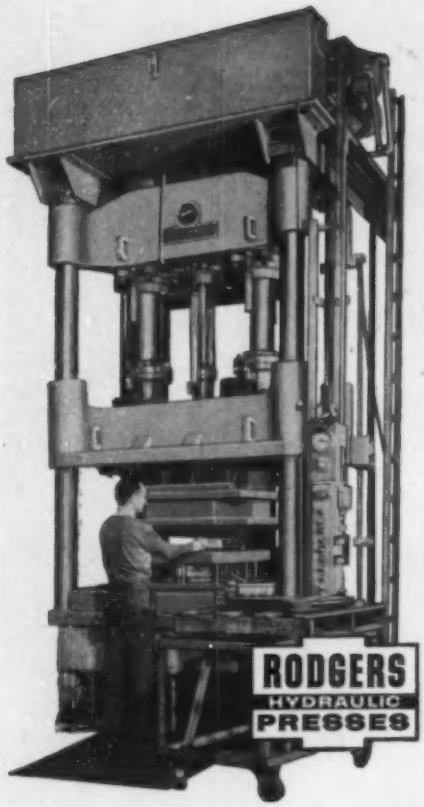

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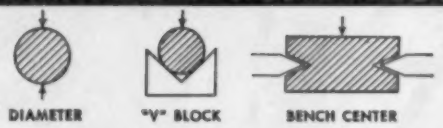
HOW DO YOU MEASURE ROUNDNESS



Out of roundness consists of an odd or even number of lobes or bumps with regular or random spacing about the part circumference. Not all of these types can be measured or even detected by the more common measurement methods.

Measurements by diametrical or "V" Block methods are a calculated risk — they seldom tell the full or correct roundness story. Both methods are completely insensitive to certain types of part lobing.

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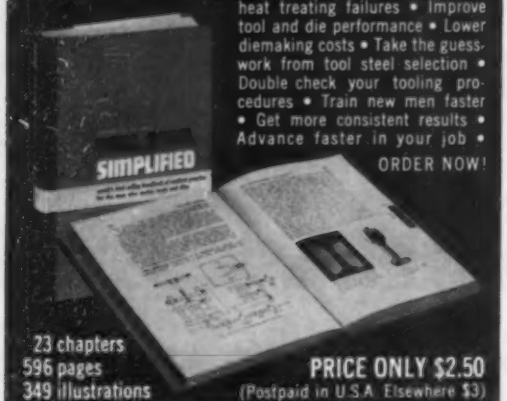

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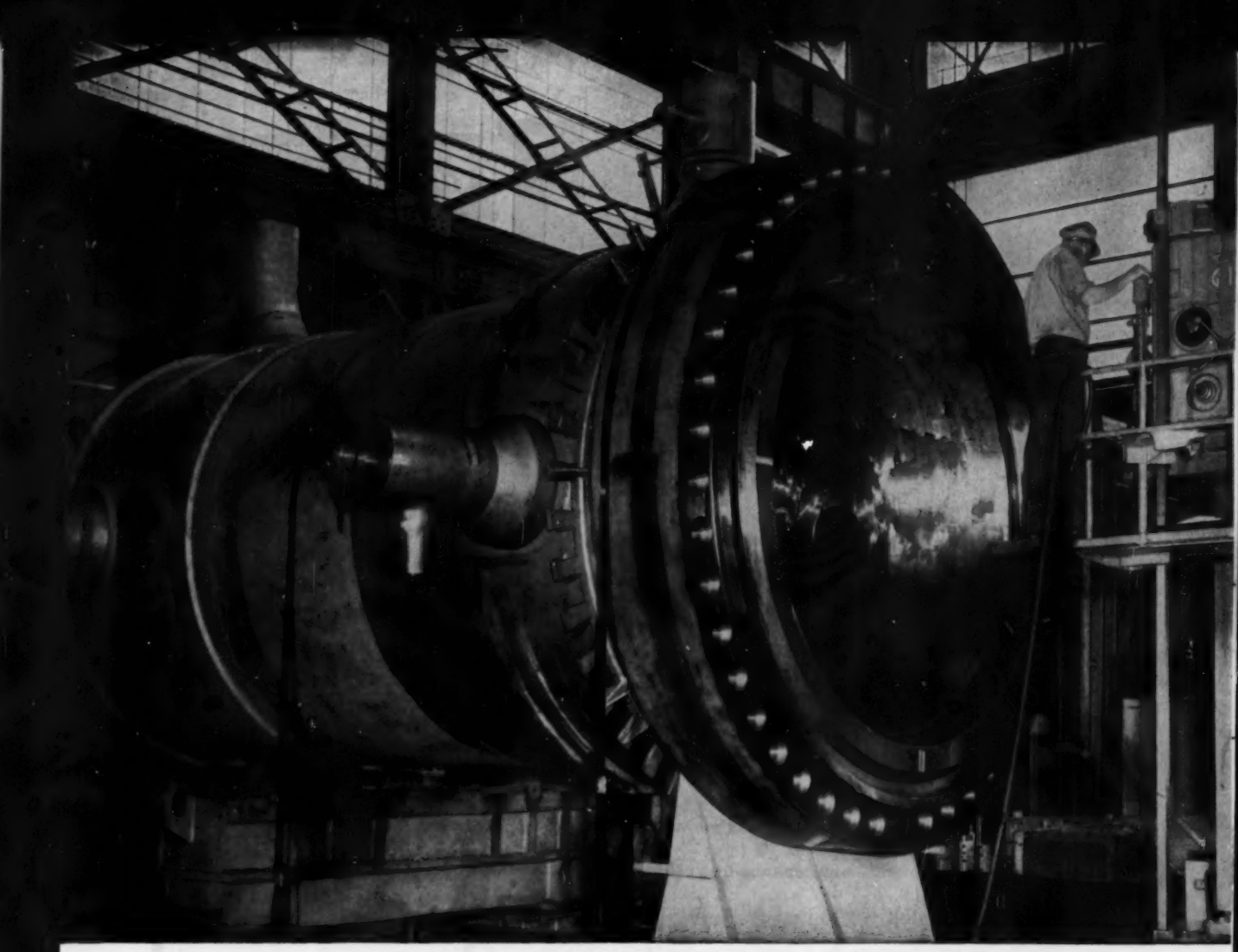

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3. Automatics
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26. Grinding Machines
31. Lathes
33. Machine Tools
37. Milling Machines
42. Planers
45. Press Brakes
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53. Saws
57. Shears

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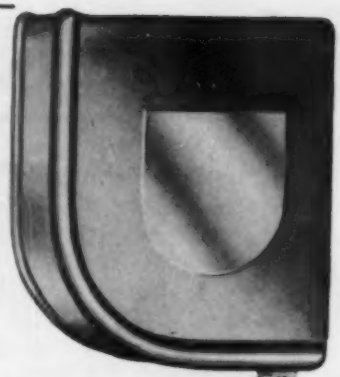

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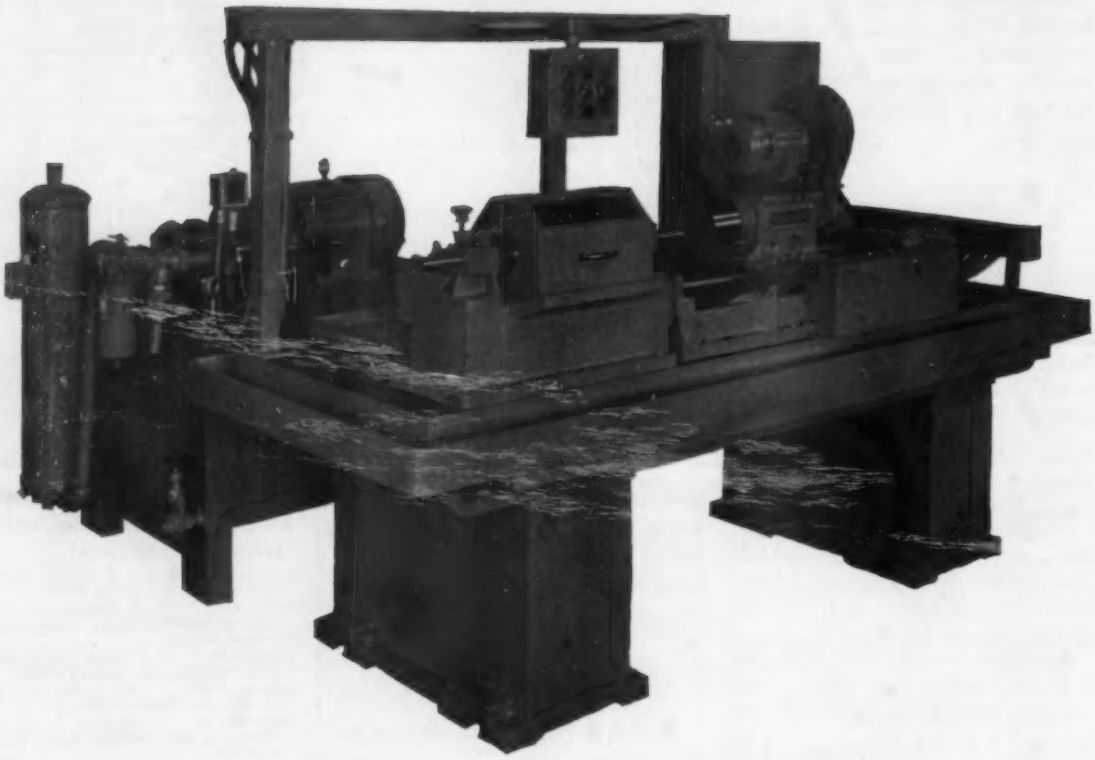

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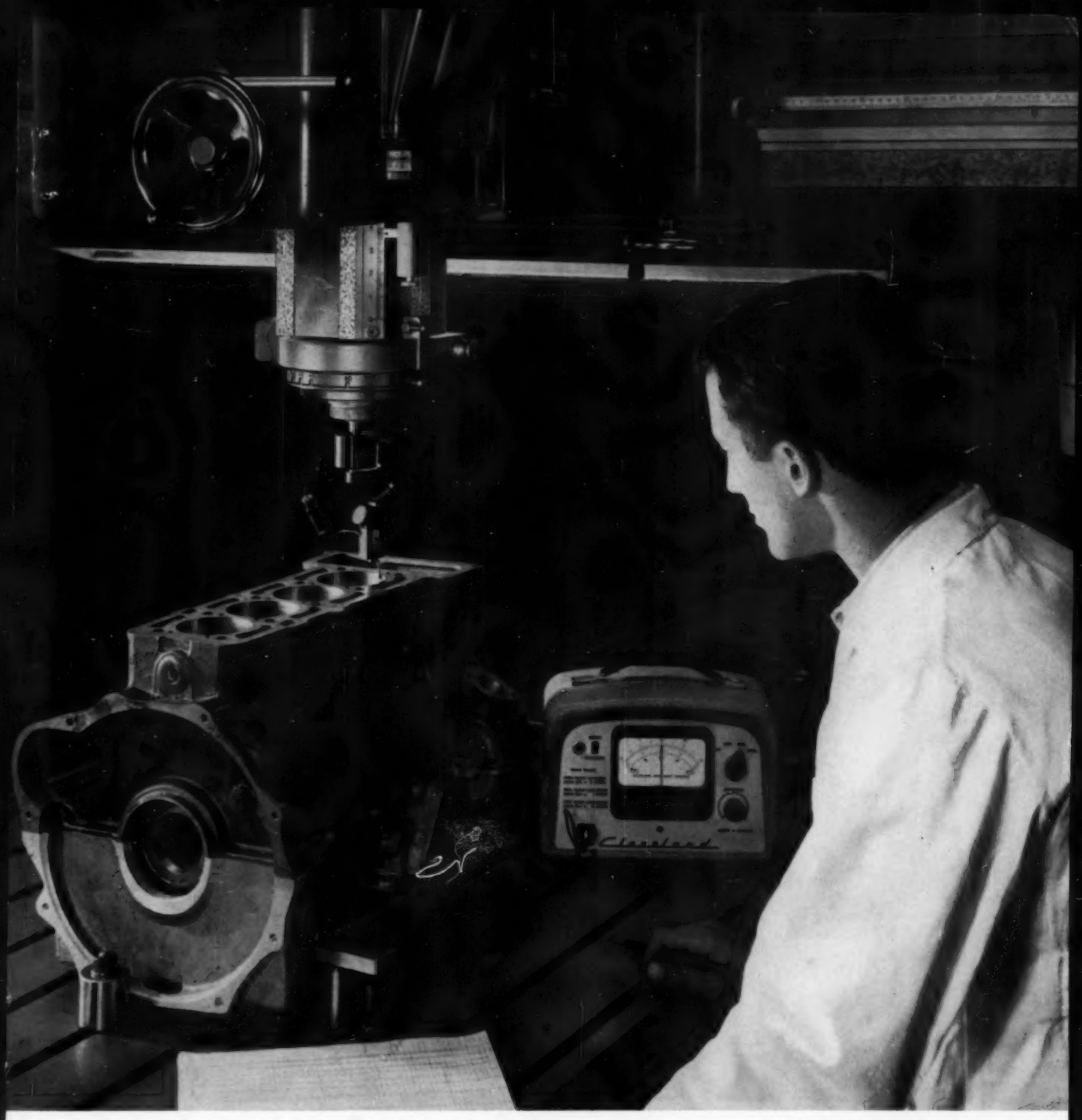

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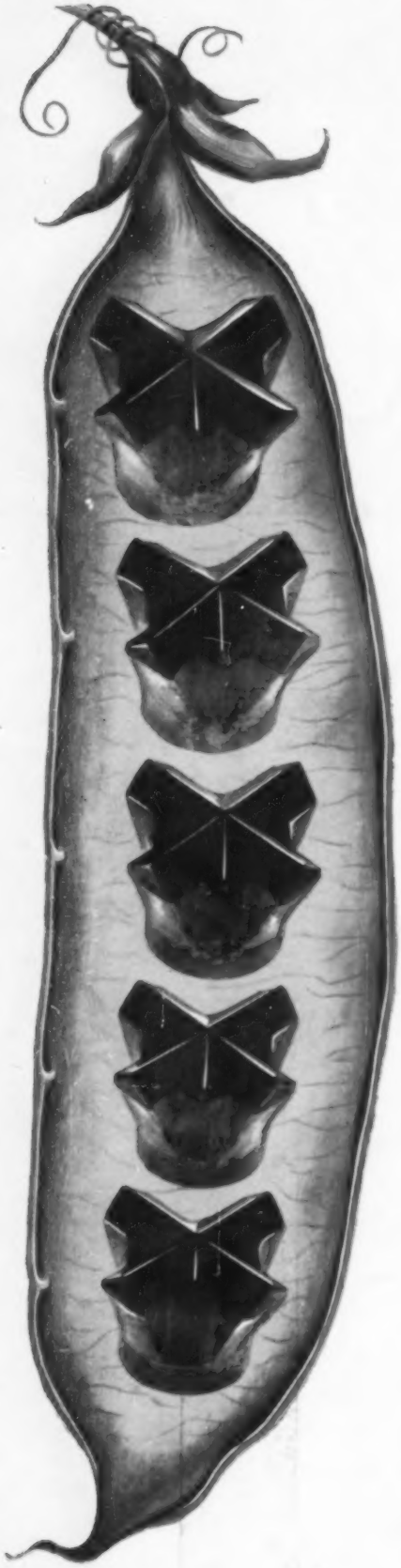

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